Air Quality Monitoring

The Lakeland Area

Alberta Environment

Spring and Fall of 2003 and 2004 — Final Report

Summary

Alberta Environment conducts mobile air quality surveys each year as part of its air quality monitoring program. These monitoring surveys are unannounced and use the Department's *Mobile Air Monitoring Laboratory* (MAML). The MAML monitoring provides a "snapshot" in time and space of the air quality at the location monitored. Pollutants measured by the MAML included ammonia, carbon monoxide, hydrocarbons (methane, total, reactive and PAHs), oxides of nitrogen (NO_2, NO and NO_x), ozone, particulate matter (TSP, PM_{10} and $PM_{2.5}$), hydrogen sulphide, total reduced sulphur and sulphur dioxide.

Alberta Environment conducted an ambient air quality monitoring survey in the Lakeland area of Alberta. 12 monitoring locations were selected in consultation with local industry and other stakeholders.

This study consisted of four surveys over the spring and fall of 2003 and 2004. During these surveys, the MAML monitored air quality for eighteen days in the Lakeland area. The objectives of monitoring this area were:

(1) to address odour complaints,

(2) to determine concentrations of air pollutants representative of the monitored locations near facilities and residences in the survey area, and

(3) to provide data to support air quality monitoring and modelling activities that have been conducted in the area.

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Each monitoring location was monitored for a minimum of one hour to allow comparison with Alberta's one-hour ambient air quality objectives. The survey obtained 46 hours of air quality data. This report presents the results of the spring (May 26 to 30, 2003 and May 31, June 1 to 4, 2004) and fall (September 8 to 12, 2003 and September 13 to 15, and 17, 2004) surveys. Results from other mobile surveys and 2003 data from permanent monitoring stations in Alberta are also presented in this report for comparison purposes.

None of the applicable objectives were exceeded during the survey at ambient site locations. Ambient levels of all air pollutants measured by the MAML were below Alberta's Ambient Air Quality Objectives.

ISBN No. 0-7785-4027-8 (Printed Edition)
Pub No. T803 (Printed, On-Line Edition)
April 27, 2005

Findings

(1) Concentrations of air pollutants measured at ambient monitoring locations in the 2003 – 2004 Lakeland Area survey were below Alberta's Ambient Air Quality Objectives (AAAQO). Alberta has one-hour air quality objectives for ammonia, carbon monoxide, nitrogen dioxide, ozone, hydrogen sulphide and sulphur dioxide. Findings from the survey and the ambient objectives can be found in Table 1.

Table 1: Summary of MAML Monitoring results for the Lakeland Area at ambient site locations.

Pollutant	Units	AAAQO	Min.	Median	Max.	% of AAAQO	Number of Exceedances
Ammonia **(NH_3)**	ppm	2	bd	0.002	0.013	0.7%	0
Carbon Monoxide **(CO)**	ppm	13	bd	0.2	0.9	6.9%	0
Hydrocarbons – Methane **(CH_4)**	ppm	n/a	1.7	2.4	4.1	--	--
Hydrocarbons – Reactive Hydrocarbons **(RHC)**	ppm	n/a	bd	0.2	4.6	--	--
Hydrocarbons – Total Hydrocarbons **(THC)**	ppm	n/a	1.8	2.6	7.2	--	--
Hydrocarbons – Polycyclic Aromatic Hydrocarbons **(PAH)**	ng/m^3	n/a	bd	bd	14.1	--	--
Nitrogen dioxide **(NO_2)**	ppm	0.212	bd	0.002	0.012	5.7%	0
Nitric Oxide **(NO)**	ppm	n/a	bd	0.004	0.053	--	--
Oxides of nitrogen **(NO_x)**	ppm	n/a	bd	0.004	0.061	--	--
Ozone **(O_3)**	ppm	0.082	0.009	0.031	0.049	60%	0
Particulates – Total Suspended Particulates **(TSP)**	$\mu g/m^3$	n/a	2	14	1505	--	--
Particulates – Particulate Matter <10µm **(PM_{10})**	$\mu g/m^3$	n/a	2	9	1074	--	--
Particulates – Particulate Matter <2.5µm **($PM_{2.5}$)**	$\mu g/m^3$	n/a	bd	1	127	--	--
Sulphur Compounds - Hydrogen Sulphide **(H_2S)**	ppm	0.010	bd	bd	0.003	30%	0
Sulphur Compounds - Total Reduced Sulphur **(TRS)**	ppm	n/a	bd	bd	0.003	--	--
Sulphur Dioxide **(SO_2)**	ppm	0.172	bd	bd	0.009	5.2%	0

$\mu g/m^3$ – micrograms per cubic metre of air ppm – parts per million ng/m^3 – nanograms per cubic meter of air

AAAQO – 1-hour Alberta Ambient Air Quality Objective n/a – no one-hour objective bd – below detection limit

(2) The one-hour maximum O_3 concentration of 0.049 ppm was measured at Devon Manatokan on May 28. This concentration is 60% of the air quality objective.

(3) The maximum one-hour H_2S concentration of 0.003 ppm measured on September 8. This concentration is 30% of the objective. Emissions during truck offloading operations at Petrovera Frog Lake were the likely source. However, the remaining measurements were low, with most falling below the minimum detection limit.

(4) The maximum one-hour PAH concentration of 14.1 ng/m^3 was measured in the afternoon of September 15, 2004. The probable source of this elevated value was exhaust emissions from vehicle traffic (diesel trucks, oilfield service vehicles).

(5) Resuspended road dust and vehicle emissions contributed to higher particulate matter levels at Petrovera Frog Lake, Ardmore, and La La Biche. On June 2, 2004 in Lac La Biche, one-hour maximum concentrations of total suspended particulates (TSP), particulate matter with a diameter less than 10 micrometers (PM_{10}) and particulate matter with a diameter less than 2.5 micrometers ($PM_{2.5}$) were 1505 µg/m^3, 1074 µg/m^3 and 127 µg/m^3, respectively. These relatively high concentrations of particulate matter may be attributed to resuspended road dust from passing vehicles; low wind speeds also may have hindered dispersion of the dust.

(6) Carbon monoxide concentrations were low. The maximum one-hour concentration of 0.9 ppm was measured on May 30, 2003 at Petrovera Frog Lake. This concentration is 6.9% of the ambient air quality objective.

(7) Hydrocarbon concentrations were low. Methane concentrations ranged from 1.7 ppm to 4.1 ppm, while total hydrocarbon concentrations ranged from 1.8 ppm to 7.2 ppm. The maximum one-hour methane concentration was measured on September 9, 2003 in Ardmore, while the maximum 1-hour total hydrocarbon concentration was measured on June 1, 2004 at Conoco Phillips.

(8) Ammonia, oxides of nitrogen, total reduced sulphur and sulphur dioxide one-hour concentrations measured at ambient site monitoring locations during the surveys were very low.

Alberta's Ambient Air Quality Objectives

Alberta's Ambient Air Quality Objectives[1] are established under Section 14 of the Environmental Protection and Enhancement Act (EPEA R.S.A. 2000, c.E-12, as amended). EPEA provides for the development of environmental objectives for Alberta.

The Ambient Air Quality Objectives are used for:

- **Reporting on the state of the atmospheric environment in Alberta.**
- **Reporting to Albertans on the quality of the air through Alberta's Air Quality Index (AQI).**
- **Establishing approval conditions for regulated industrial facilities.**
- **Evaluating proposals to construct facilities that will have air emissions.**
- **Guiding special ambient air quality surveys.**
- **Assessing compliance near major industrial air emission sources.**

Some of Alberta's Ambient Air Quality Objectives are based on odour perception. This is the case for ammonia, nitrogen dioxide and hydrogen sulphide. For these chemicals, people are likely to detect an odour at concentrations well below levels that may affect human health.

Alberta's Ambient Air Quality Objectives (AAAQO) for one-hour concentrations of pollutants monitored by the MAML and the basis for the objective are listed in Table 2.

Table 2 Alberta's Ambient Air Quality Objectives for pollutants measured by the MAML.

Pollutant	1-hour AAAQO (ppm*)	Basis for Objective
Ammonia	2	odour perception
Carbon monoxide	13	oxygen carrying capacity of blood
Nitrogen dioxide	0.212	odour perception
Ozone	0.082	reduction of lung function and effects on vegetation
Hydrogen sulphide	0.01	odour perception
Sulphur dioxide	0.172	pulmonary function

* Parts per million by volume.

[1] *Alberta Ambient Air Quality Objectives.* Alberta Environment. December 2004.

The Mobile Air Monitoring Laboratory (MAML)

The MAML is a 27-foot (8.2 m) vehicle that has been specially designed and equipped to measure air quality. It houses a variety of instruments that continuously sample the air at specified time or distance intervals. The MAML is equipped with:

- **a dual computer system custom-programmed to accept and record the measurement of air samples from each analyser,**
- **a GPS (Global Positioning System) that identifies the MAML's location as it moves around Alberta,**
- **an exhaust purifying system that minimizes emissions from the vehicle and**
- **two on-board generators that are also equipped with exhaust scrubbers**

The pollutants measured by the MAML are listed in Table 3.

Figure 1: **Alberta Environment's Mobile Air Monitoring Laboratory**

Table 3 **Pollutants monitored by the MAML (including minimum detection limits and operating ranges).**

Pollutant	Operating Range	
	Lower Detection Limit*	Upper Detection Limit**
Ammonia **(NH_3)**	0.001 ppm	5 ppm
Carbon Monoxide **(CO)**	0.1 ppm	50 ppm
Hydrocarbons – Methane **(CH_4)**	0.005 ppm	10 ppm
Hydrocarbons – Reactive Hydrocarbons **(RHC)**	0.005 ppm	20 ppm
Hydrocarbons – Total Hydrocarbons **(THC)**	0.005 ppm	20 ppm
Hydrocarbons – Polycyclic Aromatic Hydrocarbons **(PAH)**	3 ng/m^3	1000 ng/m^3
Nitrogen dioxide **(NO_2)**	0.001 ppm	1 ppm
Nitric Oxide **(NO)**	0.001 ppm	1 ppm
Oxides of nitrogen **(NO_x)**	0.001 ppm	1 ppm
Ozone **(O_3)**	0.001 ppm	0.5 ppm
Particulates – Total Suspended Particulates **(TSP)**	1 $\mu g/m^3$	1.0 g/m^3
Particulates – Particulate Matter <10µm **(PM_{10})**	1 $\mu g/m^3$	1.0 g/m^3
Particulates – Particulate Matter <2.5µm **($PM_{2.5}$)**	1 $\mu g/m^3$	1.0 g/m^3
Sulphur Compounds - Hydrogen Sulphide **(H_2S)**	0.0006 ppm	1 ppm
Sulphur Compounds - Total Reduced Sulphur **(TRS)**	0.0006 ppm	1 ppm
Sulphur Dioxide **(SO_2)**	0.0006 ppm	1 ppm

ppm - parts per million

ng/m^3 = nanograms per cubic metre

$\mu g/m^3$ = micrograms per cubic metre

g/m^3 = grams per cubic metre

* The ***lower detection limit*** indicates the *minimum* amount of pollutant and the lower limit of meteorological data can be measured by the instrument.

** The ***upper detection limit*** indicates the *maximum* amount of pollutant the instrument can detect and the upper limit for meteorological data measured. This limit is set to provide the optimum precision over that range. The upper limit can be raised, however, precision at the lower levels (where most levels are monitored) is then compromised.

Monitoring Method and Locations

Alberta Environment used the MAML to monitor air quality in the Lakeland Area. Monitoring was conducted near industries and in the communities. Air quality was monitored on the following dates, representing the spring and fall seasons:

- **Spring (May 26 to 30, 2003 and May 31 to June 2, 2004)**
- **Fall (September 8 to 12, 2003 and September 13 to17, 2004)**

The monitoring sites were selected based on public concern, consultation with the Lakeland Industry and Community Association (LICA) and select industrial facilities chosen by regional staff from Alberta Environment with consultation with local industries. MAML monitoring sites are presented in Figure 2 and described in Table 4.

Monitoring was conducted for a minimum of one hour at each location to allow comparison with Alberta's Ambient Air Quality Objectives. A total of 46 hours of data was collected at 12 sites.

Table 4 Locations monitored by the MAML (2003-2004 Lakeland Area survey).

Monitoring Location	Dates Monitored				
	Spring	Fall	Spring		Fall
	May 03	Sep 03	May 04	June 04	Sept 04
1. Petrovera cleaning plant. LSD 32-55-3 W4M	27, 30	8, 11			
2. Conoco Philips. LSD 14-24-83-7 W4M				1	14
3. St Paul. 53 St. and 50 Ave.	26, 29	8, 12			
4. JACOS Hangingstone LSD 13-26-84-11 W4M			31		
5. OPTI/Nexen Long Lake. LSD 31-85-6 W4M				1	14
6. LaCorey				3	15, 17
7. Ardmore. Hwy 892, 200m North of Town.	27, 29	9, 10			
8. Lac La Biche Provincial Building				2	13
9. Riverhurst Hall. Hwy 55 and Range Road 31	27, 28	9, 10			
10. Devon Manatokan Plant. LSD 9-14-63 W4M	28, 29	8, 11			
11. Beaver Dam				4	
12. Lake Eliza. Hwy 646 and Range Road 85	26, 30	8, 12			

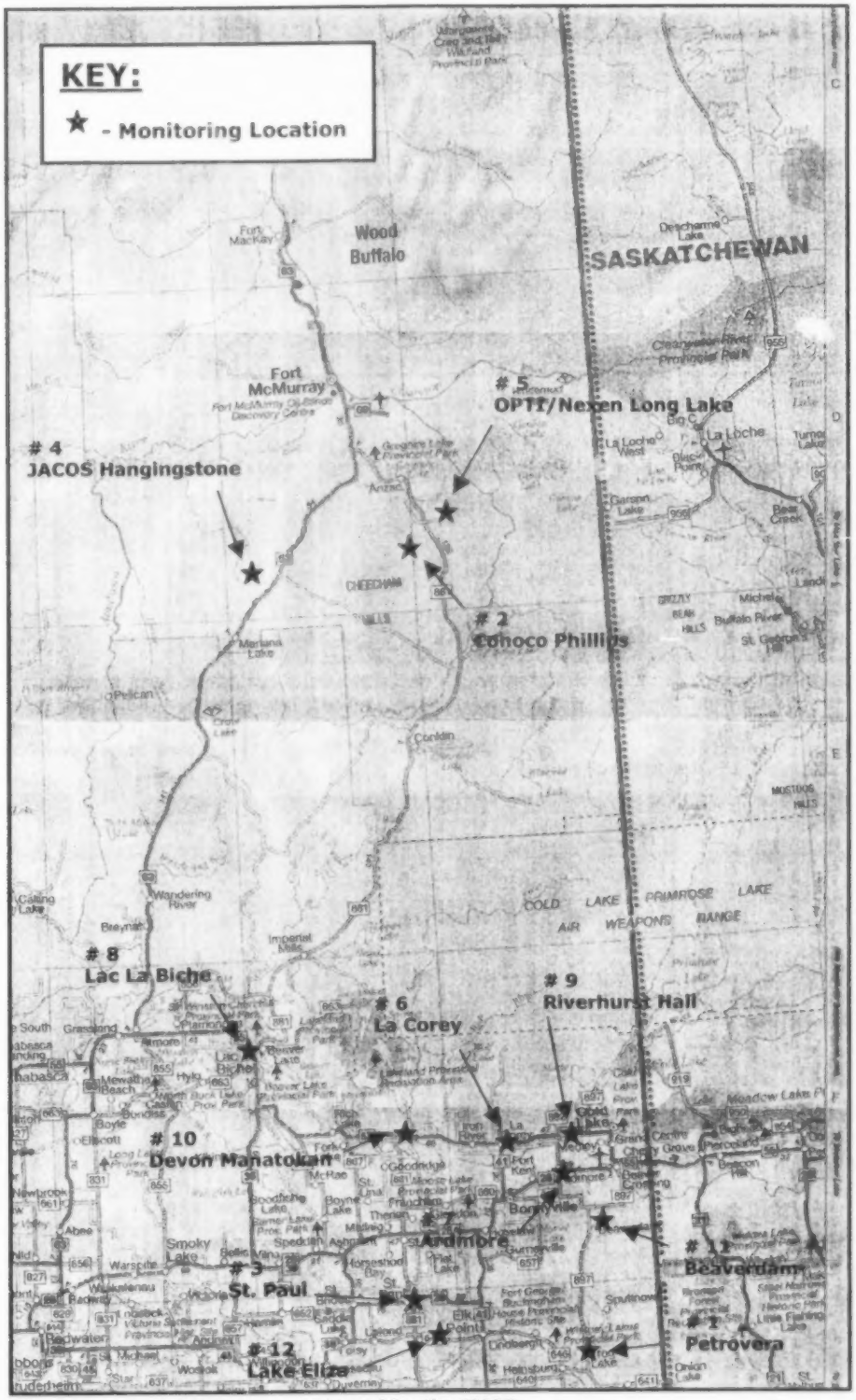

Figure 2: **Locations monitored by the MAML.**

Adapted from: MapArt, Alberta Road Atlas © 2004

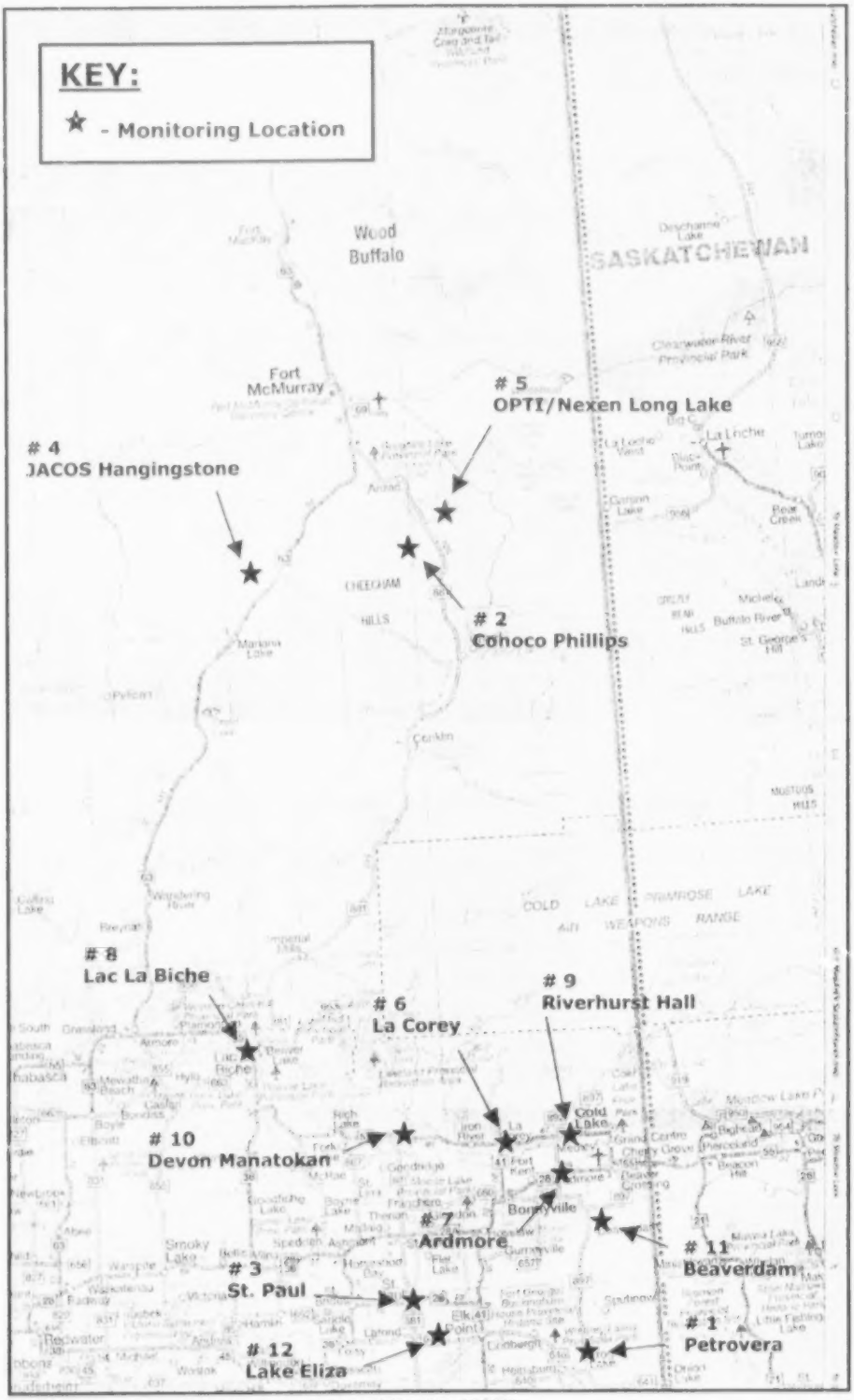

Figure 2: **Locations monitored by the MAML.**

Adapted from: MapArt, Alberta Road Atlas © 2004

Monitoring Site Photographs

Figure 3: Clockwise from upper left: north, east, south and west views of monitoring location #2 adjacent to Conoco Phillips' Operations. Most monitoring locations selected near industry were very close to the fence-line of operating sites as shown in the above images. Monitoring in such close proximity to these operations may provide information about fugitive emissions.

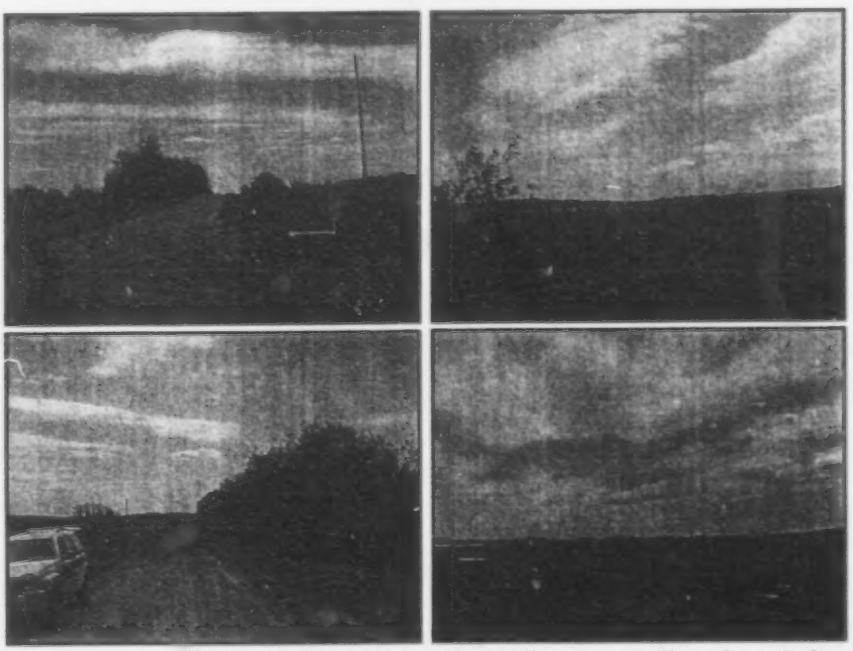

Figure 4: Clockwise from upper left: north, east, south and west views of monitoring location #6 near residences in La Corey. Monitoring sites near residences and town centres were strategically selected to minimize interference from resuspended particulate matter (road dust) and emissions from passing vehicles.

Results Discussion

Tables A1 and A2 in Appendix A contain median and maximum air pollutant concentrations at locations monitored off-site. Tables A3 and A4 show median and maximum air pollutant concentrations at other locations in Alberta, including other monitoring surveys. Hourly air pollutant concentrations for ambient site locations on each survey day are provided in Table A5. Weather conditions and the MAML operator's comments for ambient site monitoring sites are tabulated in Table A6.

In the following sections, the monitoring results are discussed and the median and maximum 1-hour concentrations are presented on accompanying graphs. The maximum concentration is the highest 1-hour concentration measured at the given location. The median concentration is a common way of representing the central value for environmental data. Most environmental data usually consist of a distribution that is skewed to the right; that is most data values are low and only a few are high. The arithmetic mean will be biased by the high concentrations and will reveal a value that may not be representative of the central value for the data set. The median is the middlemost value in the data set, dividing the distribution into two equal halves. Therefore, the median is more representative of the central value of the data distribution. Fifty percent of the values in the dataset are below the median and fifty percent are above.

For example, consider a data distribution consisting of five numbers: 1, 2, 2, 3 and 10. The arithmetic mean of these data is 3.6 and the median is 2. In this case, the arithmetic mean is biased high by the extreme value of 10. The median value is actually a true central value of the data distribution.

Many areas in Alberta are pristine and certain pollutants that Alberta Environment monitors for are found in concentrations below the lower detection limit of the instruments onboard the MAML. Consider a dataset that contains 4 concentrations below the detection limit and 1 concentration within the operating range of the MAML instruments; with this data set, it is possible to have an overall median concentration that is 'undetectable' or below the lower detection limit while still having a 'detectable' maximum value.

The following diagram explains how to interpret the graphs in the following sections:

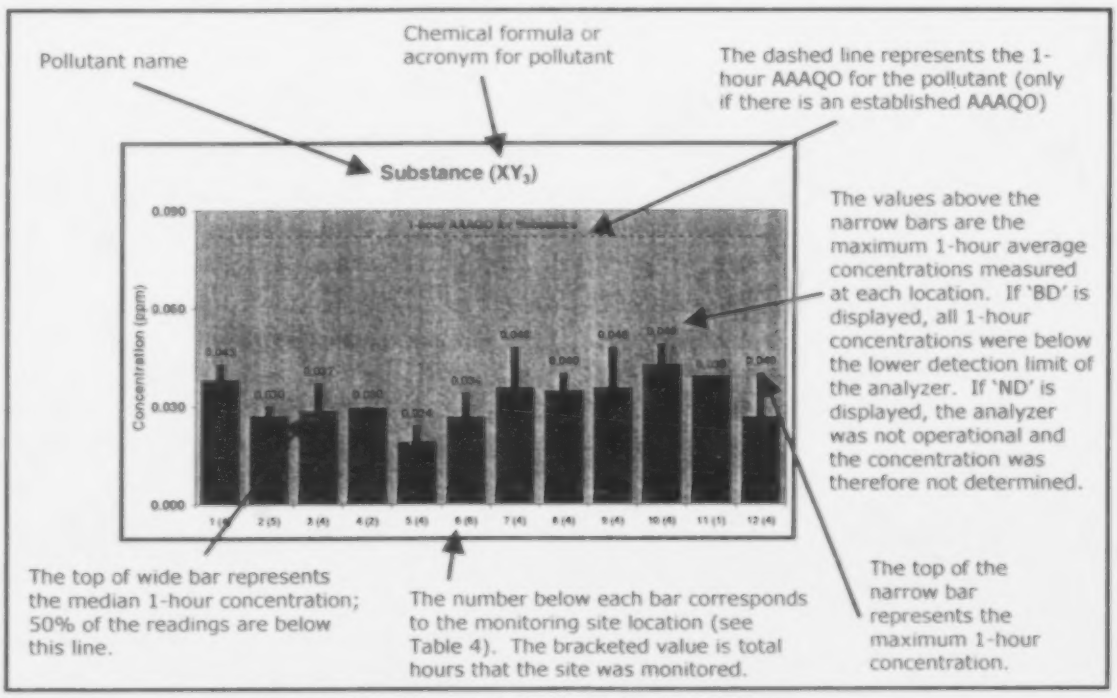
Pollutant name
Chemical formula or acronym for pollutant
The dashed line represents the 1-hour AAAQO for the pollutant (only if there is an established AAAQO)
Substance (XY_3)
Concentration (ppm)
0.090
0.060
0.030
0.000
The values above the narrow bars are the maximum 1-hour average concentrations measured at each location. If 'BD' is displayed, all 1-hour concentrations were below the lower detection limit of the analyzer. If 'ND' is displayed, the analyzer was not operational and the concentration was therefore not determined.
The top of wide bar represents the median 1-hour concentration; 50% of the readings are below this line.
The number below each bar corresponds to the monitoring site location (see Table 4). The bracketed value is total hours that the site was monitored.
The top of the narrow bar represents the maximum 1-hour concentration.

Figure 5: Key for interpreting the graphs in the following section.

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Many areas in Alberta are pristine and certain pollutants that Alberta Environment monitors for are found in concentrations below the lower detection limit of the instruments onboard the MAML. Consider a dataset that contains 4 concentrations below the detection limit and 1 concentration within the operating range of the MAML instruments; with this data set, it is possible to have an overall median concentration that is 'undetectable' or below the lower detection limit while still having a 'detectable' maximum value.

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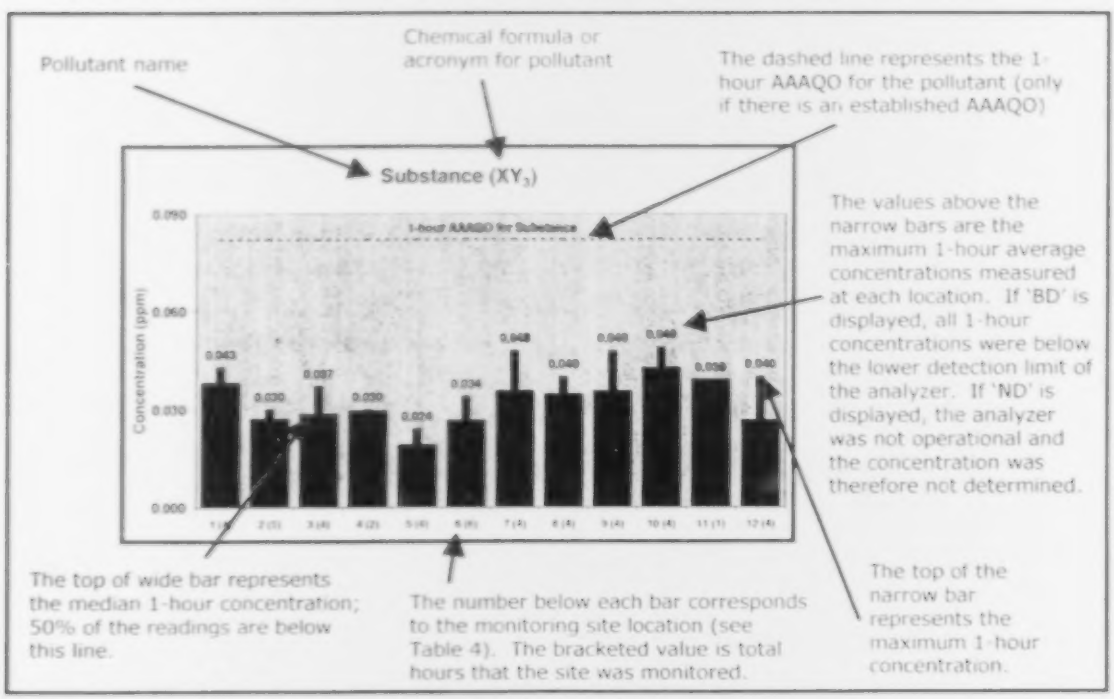
Pollutant name
Chemical formula or acronym for pollutant
The dashed line represents the 1-hour AAAQO for the pollutant (only if there is an established AAAQO)
Substance (XY3)
1-hour AAAQO for Substance
Concentration (ppm)
0.090
0.060
0.030
0.000
0.043
0.030
0.037
0.030
0.024
0.034
0.048
0.040
0.040
0.048
0.038
0.040
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The number below each bar corresponds to the monitoring site location (see Table 4). The bracketed value is total hours that the site was monitored.
The top of the narrow bar represents the maximum 1-hour concentration.

Figure 5: Key for interpreting the graphs in the following section.

Ammonia (NH_3)

Ammonia is a colourless gas with the well-known pungent odour; it is commonly found in household cleaners. NH_3 is produced both by natural and man-made sources. Some natural sources of NH_3 include the decay of plant material and animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of NH_3. The industry produces synthetic NH_3 for either direct application to soil as a fertilizer or as a raw material for use in the production of other high nitrogen fertilizer products. The other major source of NH_3 is commercial feedlots, specifically from their large amounts of decaying animal wastes.

Ammonia levels were very low at all monitoring locations in the 2003-2004 Lakeland Area survey area, as can be seen in Figure 5.

The highest one-hour NH_3 concentration detected during the survey (0.013 ppm) was measured at OPTI-Nexen on Sept 14, 2004. The maximum NH_3 concentration measured at this site is less than one per cent of the one-hour ambient air quality objective.

The overall median NH_3 concentration for this survey was 0.002 ppm.

NH_3 concentrations measured in this survey are generally lower than concentrations found in other MAML surveys. Maximum one-hour NH_3 concentrations from other MAML surveys ranged from 0.005 ppm (2001/2002 Cold Lake/Bonnyville survey) to 0.557 ppm (2001/2002 Fort Saskatchewan/Redwater survey).

Ammonia is not typically measured at Alberta's permanent air monitoring stations.

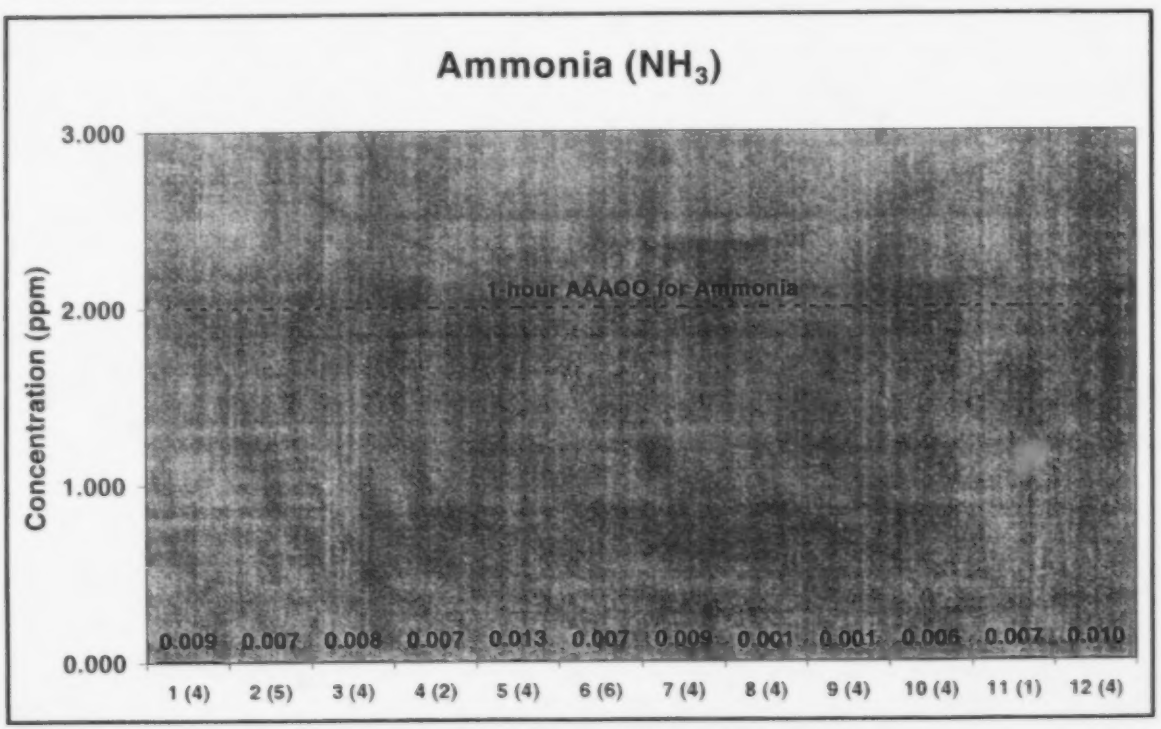

Figure 6: **One-hour median and maximum concentrations for ammonia.**

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion. The major source of carbon monoxide in urban locations is vehicle exhaust emissions.

CO values were very low at all ambient site monitoring locations in the 2003-2004 Lakeland Area survey as can be seen in Figure 6. The maximum one-hour CO concentration of 0.9 ppm was recorded at Petrovera Frog Lake on May 30, 2003. The maximum one-hour concentration is seven per cent of the one-hour objective for CO. Probable sources of CO at these locations include emissions from trucks and storage tank heaters.

The overall median concentration in the Lakeland Area survey was 0.2 ppm.

CO concentrations measured during this survey were lower than concentrations from other surveys. Maximum one-hour CO concentrations from other MAML surveys ranged from 0.5 ppm (2000/2001 Wabuman survey) to 2.7 ppm (2000/2001 Edmonton - Whitemud Drive survey).

The maximum one-hour CO level measured by a permanent monitoring station was 6.5 ppm (Edmonton Central) in 2003.

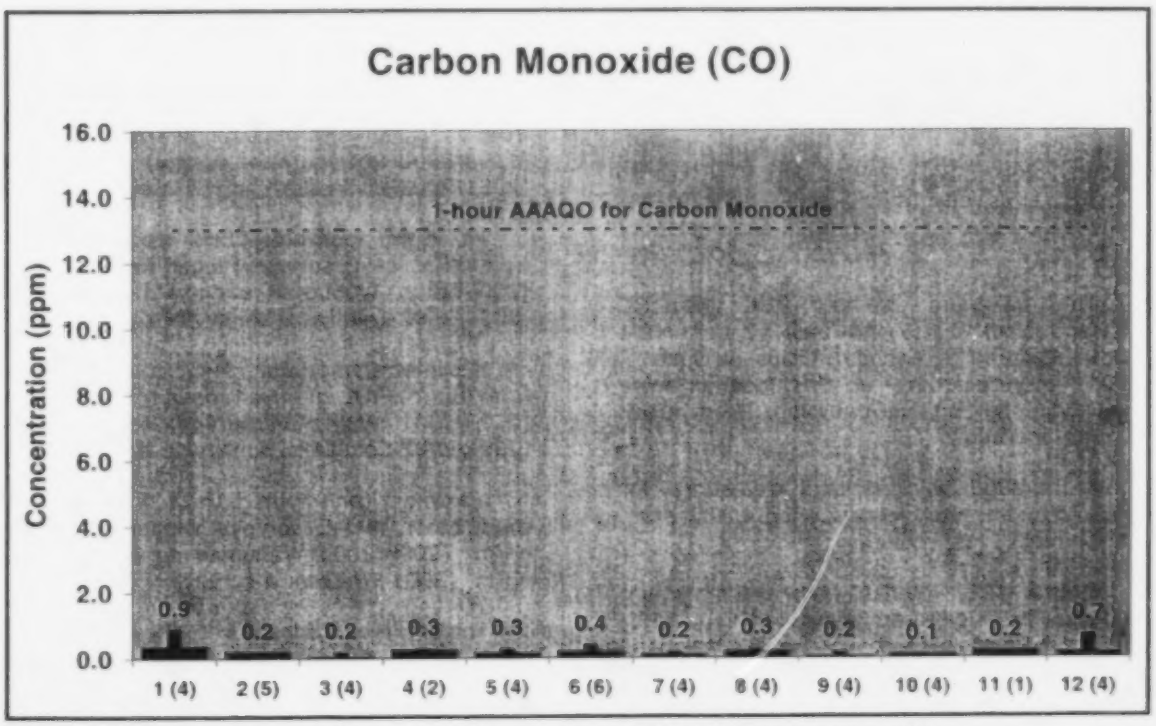

Figure 7: **One-hour median and maximum concentrations for carbon monoxide.**

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Ammonia levels were very low at all monitoring locations in the 2003-2004 Lakeland Area survey area, as can be seen in Figure 5.

The highest one-hour NH_3 concentration detected during the survey (0.013 ppm) was measured at OPTI-Nexen on Sept 14, 2004. The maximum NH_3 concentration measured at this site is less than one per cent of the one-hour ambient air quality objective.

The overall median NH_3 concentration for this survey was 0.002 ppm.

NH_3 concentrations measured in this survey are generally lower than concentrations found in other MAML surveys. Maximum one-hour NH_3 concentrations from other MAML surveys ranged from 0.005 ppm (2001/2002 Cold Lake/Bonnyville survey) to 0.557 ppm (2001/2002 Fort Saskatchewan/Redwater survey).

Ammonia is not typically measured at Alberta's permanent air monitoring stations.

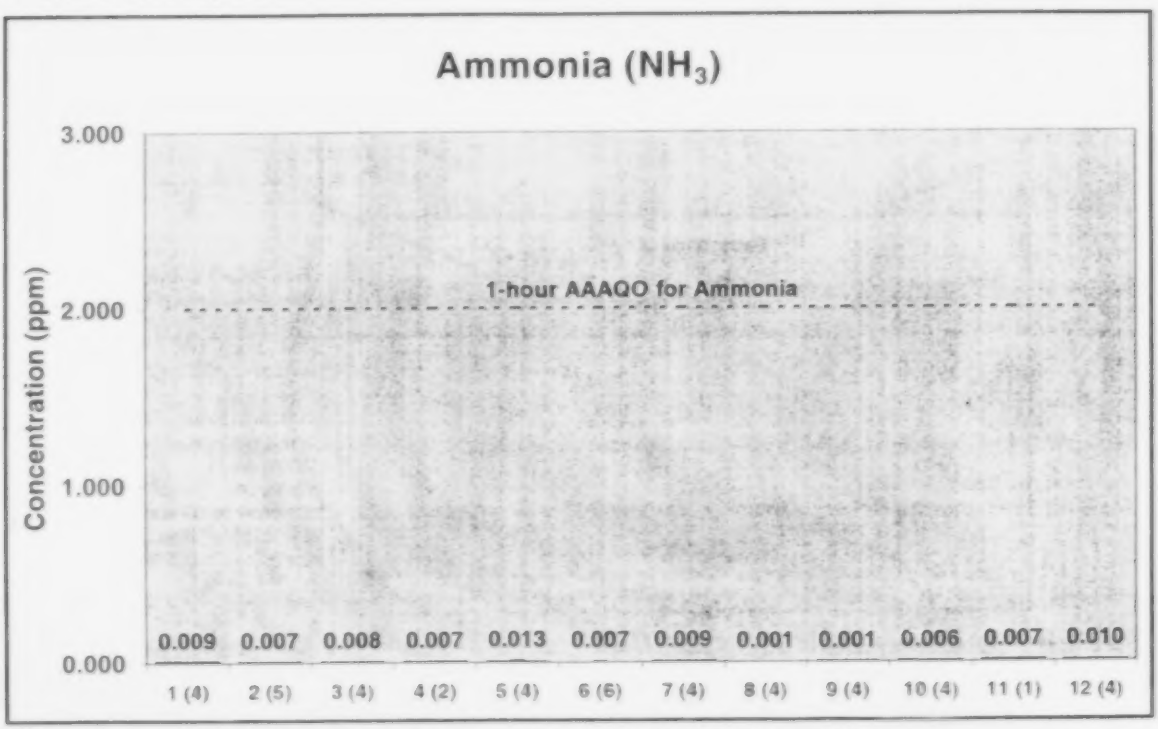

Figure 6: **One-hour median and maximum concentrations for ammonia.**

Carbon Monoxide (CO)

Carbon monoxide (CO) is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion. The major source of carbon monoxide in urban locations is vehicle exhaust emissions.

CO values were very low at all ambient site monitoring locations in the 2003-2004 Lakeland Area survey as can be seen in Figure 6. The maximum one-hour CO concentration of 0.9 ppm was recorded at Petrovera Frog Lake on May 30, 2003. The maximum one-hour concentration is seven per cent of the one-hour objective for CO. Probable sources of CO at these locations include emissions from trucks and storage tank heaters.

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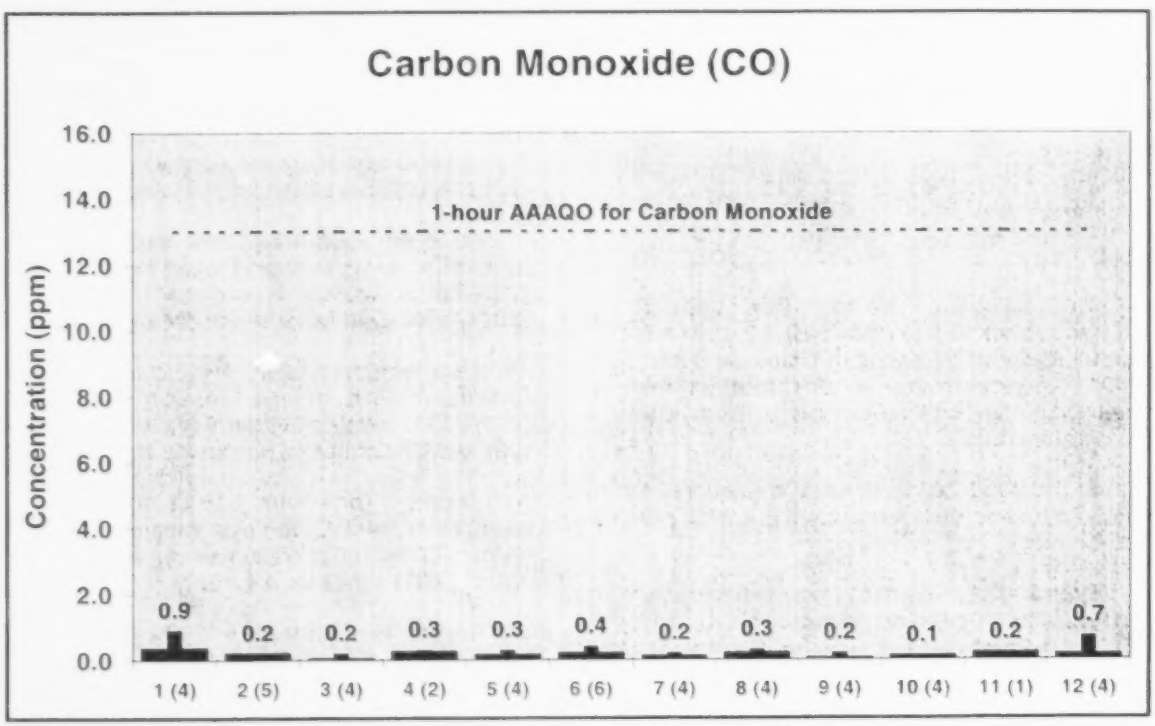


Figure 7: **One-hour median and maximum concentrations for carbon monoxide.**

Hydrocarbons (CH_4, RHC, THC, PAHs)

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH_4) is the most common natural hydrocarbon in the earth's atmosphere. Reactive hydrocarbons (RHC) are important because they can contribute to summertime smog or be toxic at high concentrations. Some sources of hydrocarbons include vegetation, vehicle emissions, oil and gas processing, chemical processing, dry cleaning, fireplaces, natural gas combustion, aircraft traffic and evaporation of solvents.

Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are usually contained in soot and smoke. There are more than 100 different PAHs with varying levels of toxicity. They are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle emissions, wood smoke from fireplaces, smoke from forest fires and industrial facilities. PAHs occur in the atmosphere in the vapour phase or attached to dust particles. The PAH monitoring instrument aboard the MAML will analyze only particulate bound PAHs.

The maximum one-hour CH_4 concentration of 4.1 ppm was measured in the town of Ardmore on September 9, 2003. The maximum one-hour PAHs concentration of 14.1 ng/m^3 was measured in La Corey on September 15, 2004. The high PAHs values were likely due to exhaust emissions from vehicle traffic (diesel exhaust, oilfield service vehicles and light duty trucks).

The maximum one-hour RHC and THC concentrations of 4.6 ppm and 7.2 ppm were both measured at Conoco Phillips on June 1, 2004. Hydrocarbons at this location were likely due to fugitive emissions from truck loading operations.

in the 2003-2004 Lakeland Area survey for CH_4, RHC, and THC were 2.4 ppm, 0.2 ppm, 2.6 ppm and, respectively.

Figures 7, 8, 9 and 10 show the maximum and median monitored levels for CH_4, RHC, THC and PAHs, respectively for the Lakeland area survey.

The hydrocarbon concentrations measured during the 2003-2004 Lakeland study are within the ranges of concentrations measured in other MAML surveys.

Maximum one-hour CH_4 concentrations from other MAML surveys ranged from 2.2 ppm (1999/2000 Bow Corridor survey) to 4.6 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour RHC concentrations from other MAML surveys ranged from 0.5 ppm (2000/2001 Wabuman survey) to 7.1 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour THC concentrations from other MAML surveys ranged from 3.3 ppm (2000/2001 Wabuman survey) to 9.7 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour PAHs concentrations from other MAML surveys ranged form 11 ng/m^3 (2000/2001 Wabuman survey) to 113 ng/m^3 (2001 Whitecourt survey).

The maximum one-hour THC concentration measured by a permanent monitoring station was 14.7 ppm (Edmonton East) in 2003. CH_4, RHC and PAHs are typically not measured at permanent monitoring stations.

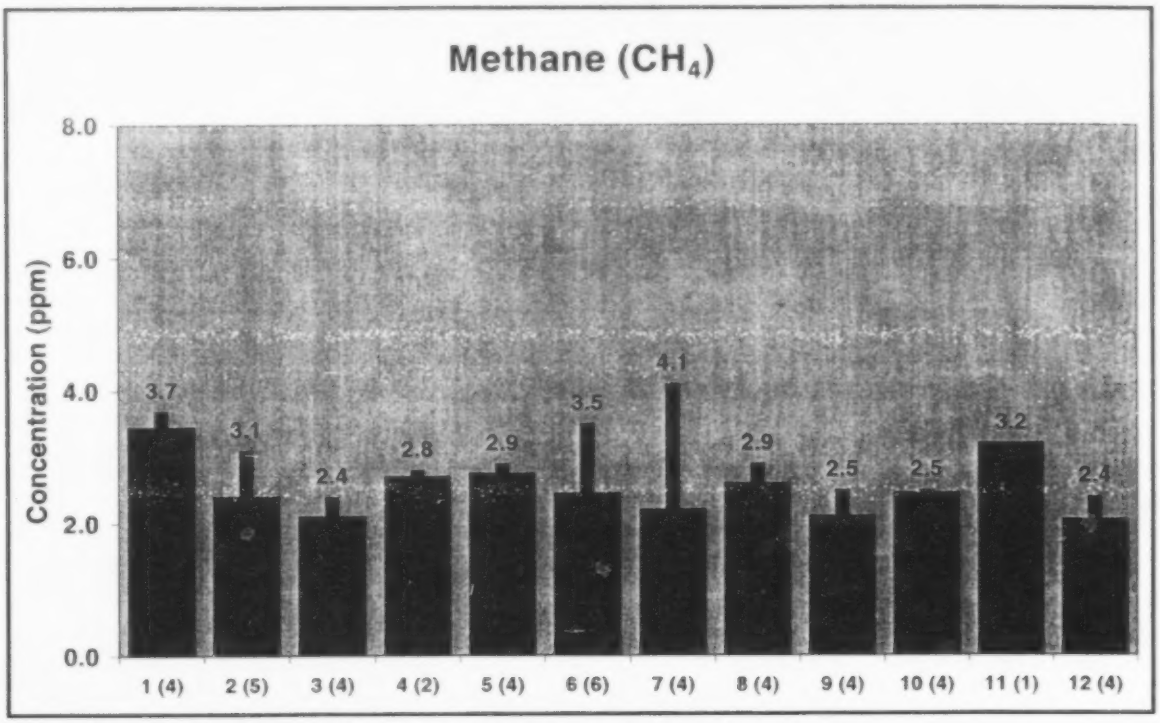


Figure 8: One-hour median and maximum concentrations for methane.

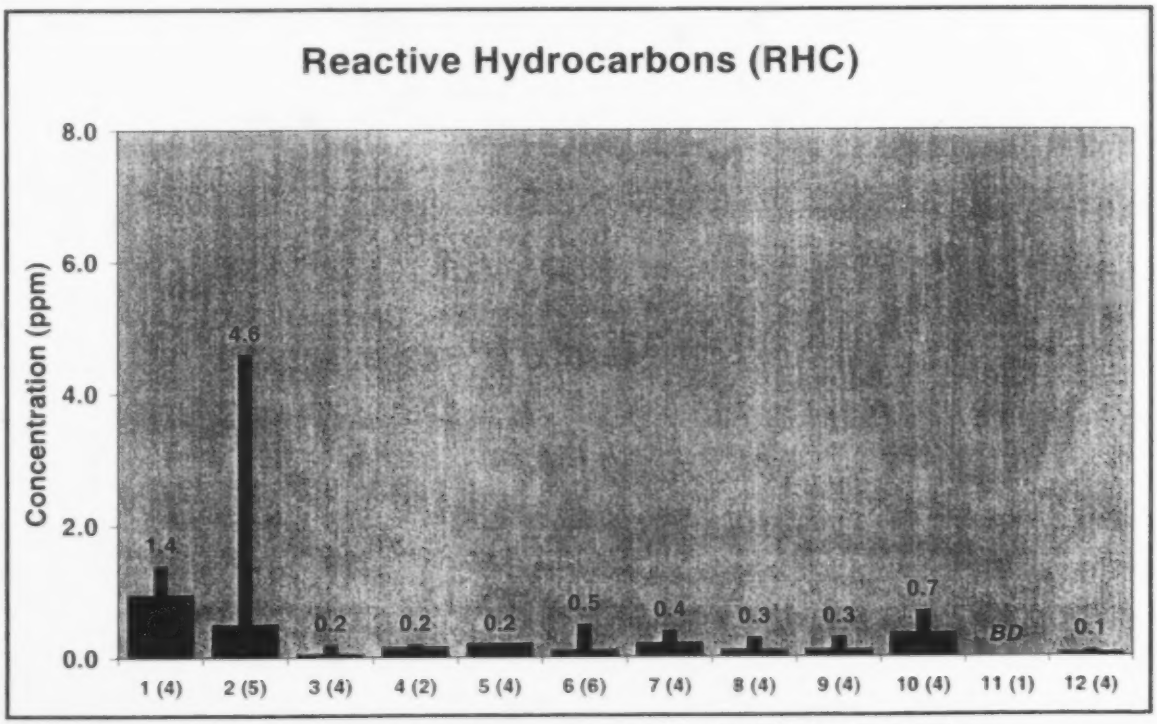


Figure 9: One-hour median and maximum concentrations for reactive hydrocarbons.

Hydrocarbons (CH_4, RHC, THC, PAHs)

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH_4) is the most common natural hydrocarbon in the earth's atmosphere. Reactive hydrocarbons (RHC) are important because they can contribute to summertime smog or be toxic at high concentrations. Some sources of hydrocarbons include vegetation, vehicle emissions, oil and gas processing, chemical processing, dry cleaning, fireplaces, natural gas combustion, aircraft traffic and evaporation of solvents.

Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are usually contained in soot and smoke. There are more than 100 different PAHs with varying levels of toxicity. They are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle emissions, wood smoke from fireplaces, smoke from forest fires and industrial facilities. PAHs occur in the atmosphere in the vapour phase or attached to dust particles. The PAH monitoring instrument aboard the MAML will analyze only particulate bound PAHs.

The maximum one-hour CH_4 concentration of 4.1 ppm was measured in the town of Ardmore on September 9, 2003. The maximum one-hour PAHs concentration of 14.1 ng/m^3 was measured in La Corey on September 15, 2004. The high PAHs values were likely due to exhaust emissions from vehicle traffic (diesel exhaust, oilfield service vehicles and light duty trucks).

The maximum one-hour RHC and THC concentrations of 4.6 ppm and 7.2 ppm were both measured at Conoco Phillips on June 1, 2004. Hydrocarbons at this location were likely due to fugitive emissions from truck loading operations.

in the 2003-2004 Lakeland Area survey for CH_4, RHC, and THC were 2.4 ppm, 0.2 ppm, 2.6 ppm and, respectively.

Figures 7, 8, 9 and 10 show the maximum and median monitored levels for CH_4, RHC, THC and PAHs, respectively for the Lakeland area survey.

The hydrocarbon concentrations measured during the 2003-2004 Lakeland study are within the ranges of concentrations measured in other MAML surveys.

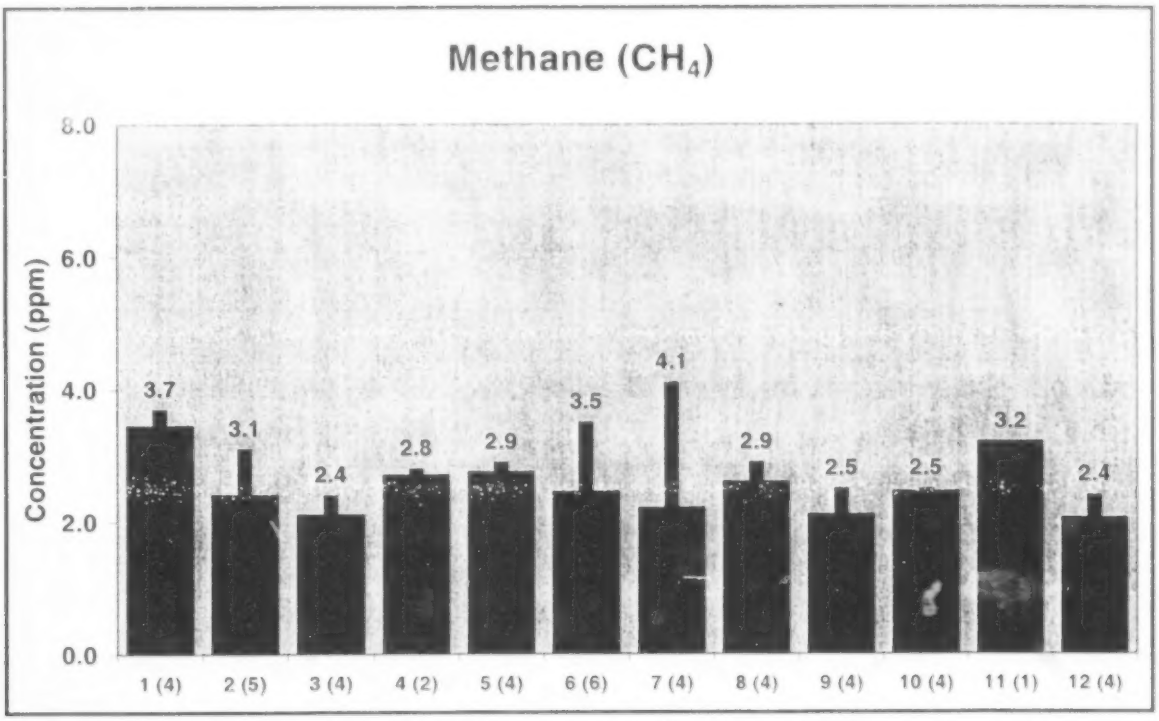
Maximum one-hour CH_4 concentrations from other MAML surveys ranged from 2.2 ppm (1999/2000 Bow Corridor survey) to 4.6 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour RHC concentrations from other MAML surveys ranged from 0.5 ppm (2000/2001 Wabuman survey) to 7.1 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour THC concentrations from other MAML surveys ranged from 3.3 ppm (2000/2001 Wabuman survey) to 9.7 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour PAHs concentrations from other MAML surveys ranged form 11 ng/m^3 (2000/2001 Wabuman survey) to 113 ng/m^3 (2001 Whitecourt survey).

The maximum one-hour THC concentration measured by a permanent monitoring station was 14.7 ppm (Edmonton East) in 2003. CH_4, RHC and PAHs are typically not measured at permanent monitoring stations.



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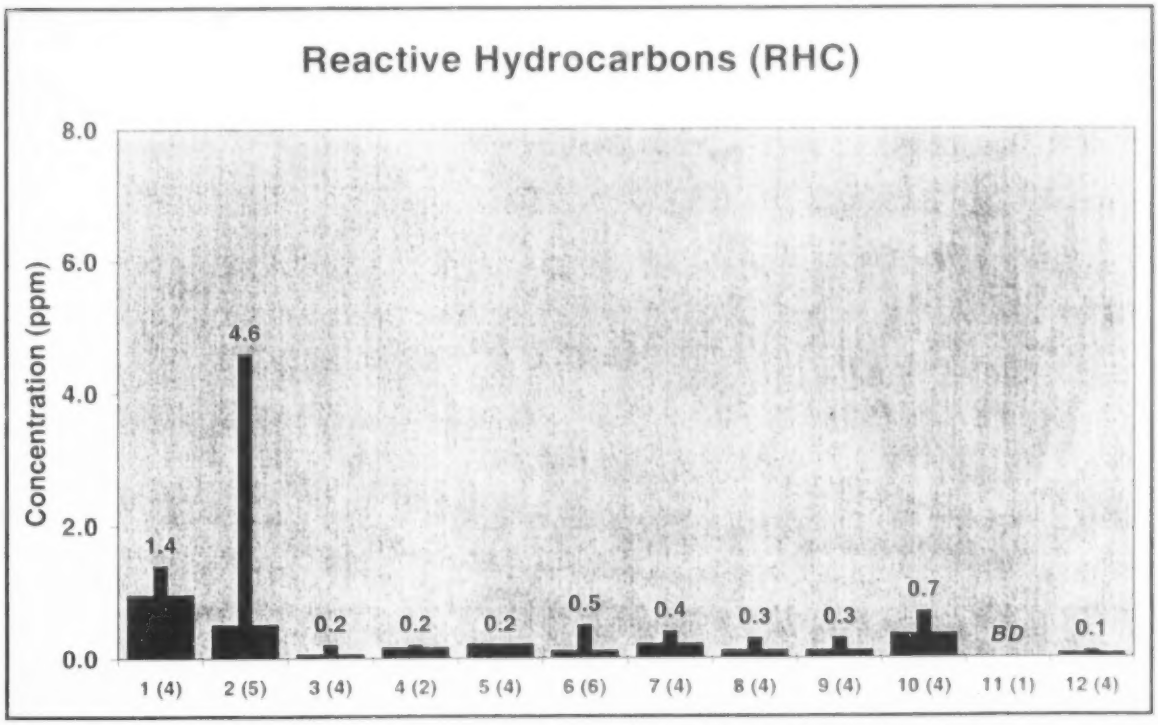


Figure 9: One-hour median and maximum concentrations for reactive hydrocarbons.

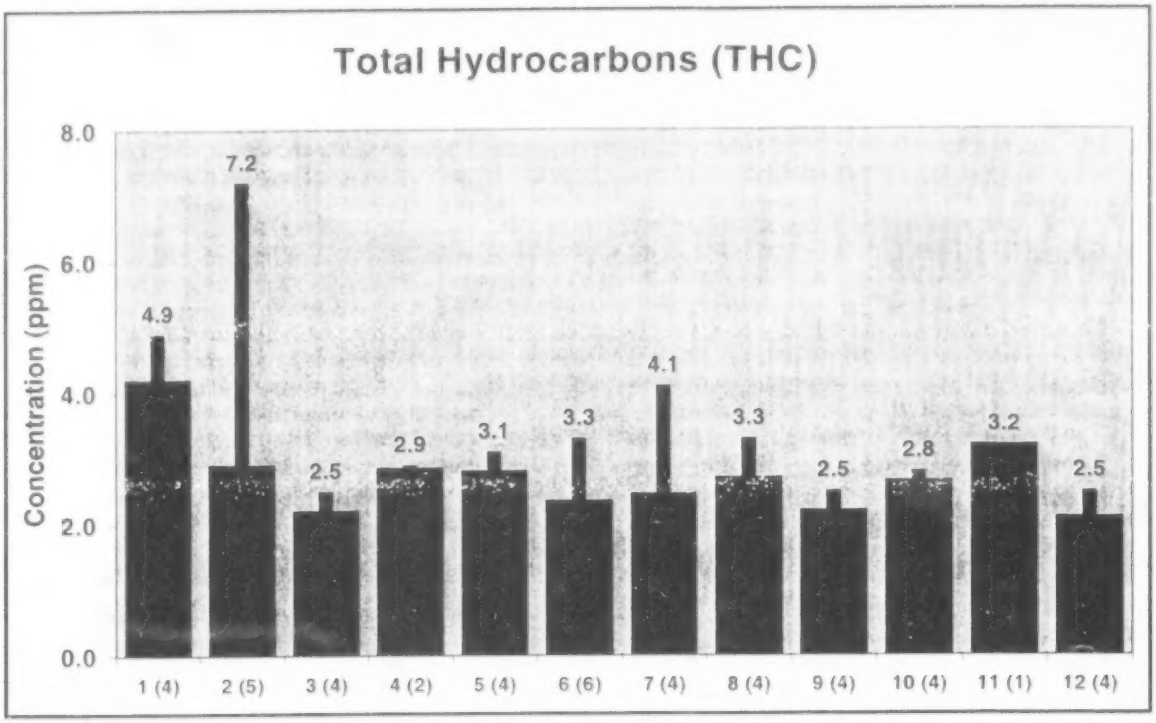


Figure 10: One-hour median and maximum concentrations for total hydrocarbons.

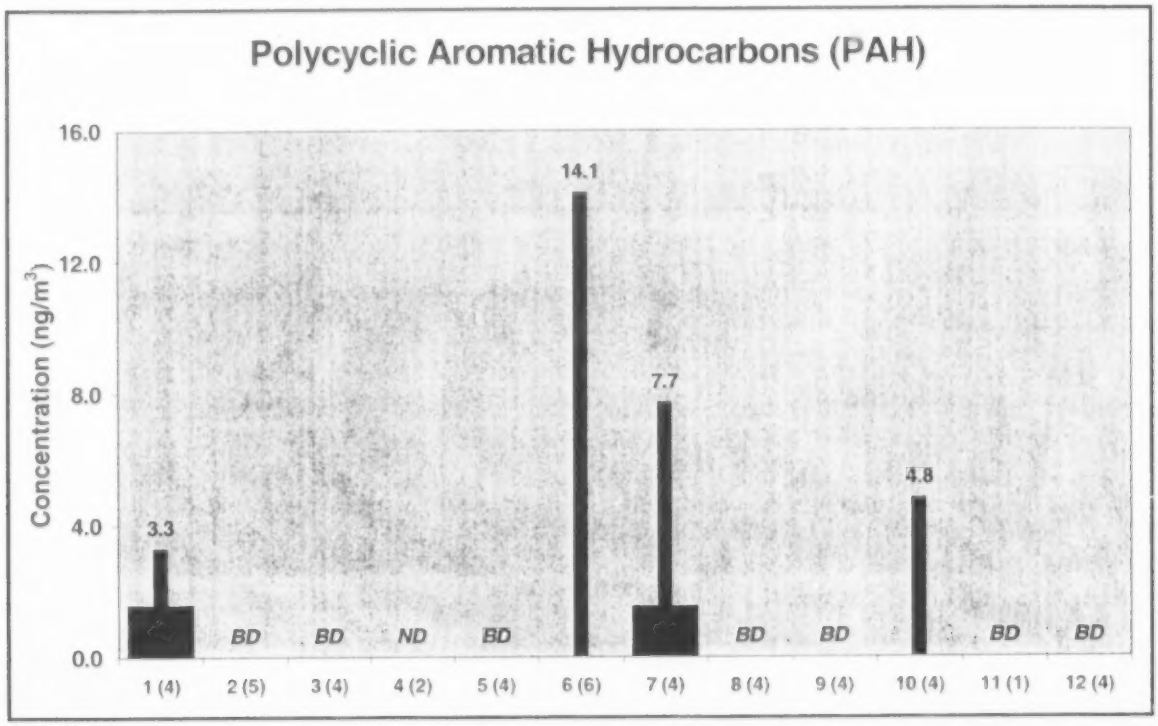


Figure 11: One-hour median and maximum concentrations for polycyclic aromatic hydrocarbons.

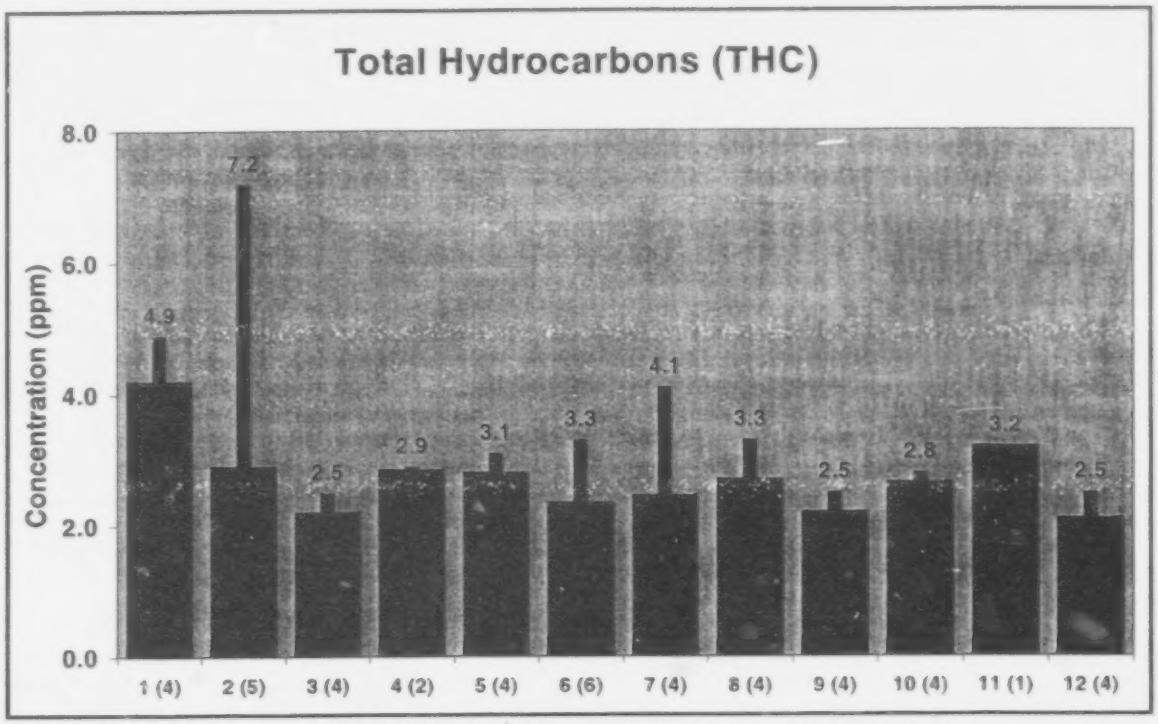


Figure 10: One-hour median and maximum concentrations for total hydrocarbons.

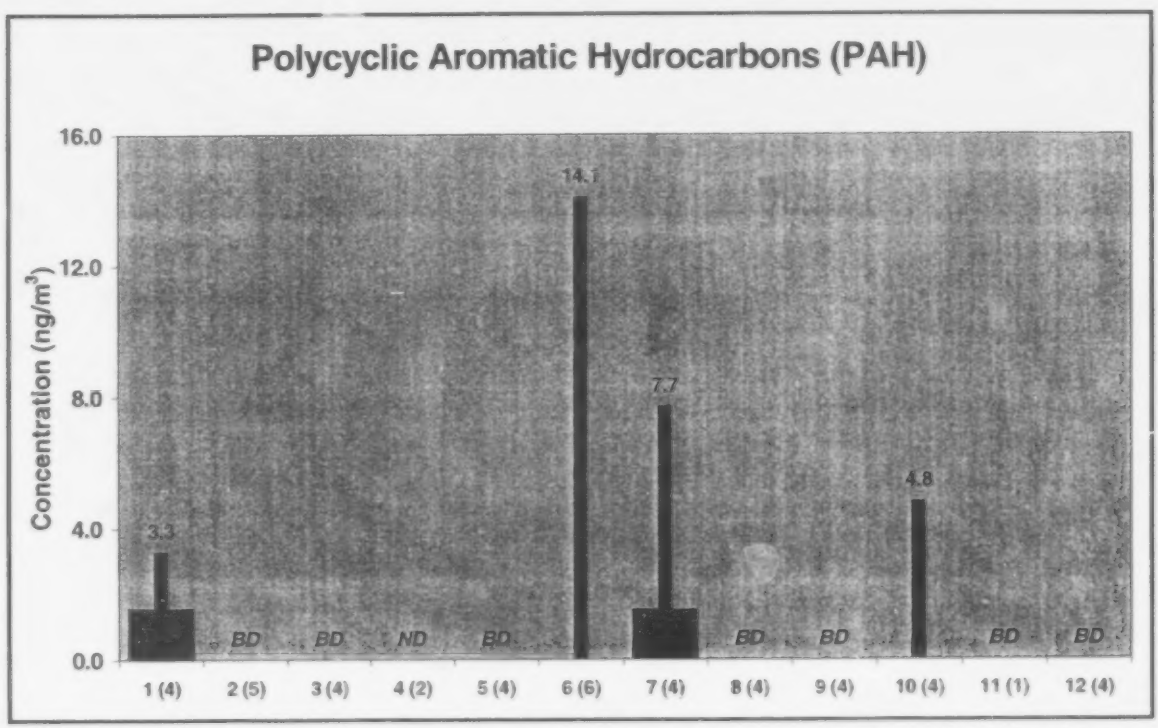


Figure 11: One-hour median and maximum concentrations for polycyclic aromatic hydrocarbons.

Oxides of Nitrogen (NO_2, NO, NO_x)

Oxides of nitrogen (NO_x) are the total of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion - as in the burning of natural gas, coal, oil and gasoline - atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless and odourless. Most NO in the ambient air is oxidized to form NO_2. NO_2 is a reddish-brown gas with a pungent odour. The major sources of oxides of nitrogen in urban areas are vehicle emissions and emissions from power plants. Processes associated with the oil and gas industry also emit oxides of nitrogen into the atmosphere.

Nitrogen dioxide concentrations were well below Alberta's ambient air quality objectives in the Lakeland area survey, as shown in Figure 11.

Concentrations for nitric oxide and oxides of nitrogen are shown in Figures 12 and 13.

The maximum one-hour NO_2 concentration of 0.012 ppm was recorded at OPTI/Nexen on September 14. 2004. This NO_2 concentration is four percent of the one-hour objective. The probable source of NO_2 monitored was vehicle emissions.

Other potential sources of NO_x in this survey include emissions from vehicles, jets (from the air force base), steam generators (heavy oil thermal plants), compressors (compressor stations) and storage tank heaters.

The overall NO_2 median concentration in the 2003-2004 Lakeland Area survey was 0.002 ppm.

The maximum NO_2 concentrations measured during this survey are lower than concentrations measured in other surveys. Maximum 1-hour NO_2 concentration from other MAML surveys range from 0.014 ppm (2001/2002 Cold Lake/Bonnyville survey) to 0.051 ppm (2001/2002 Fort Saskatchewan/Redwater survey).

The maximum one-hour NO_2 concentration measured by a permanent monitoring station was 0.114 ppm (Calgary East) in 2003.

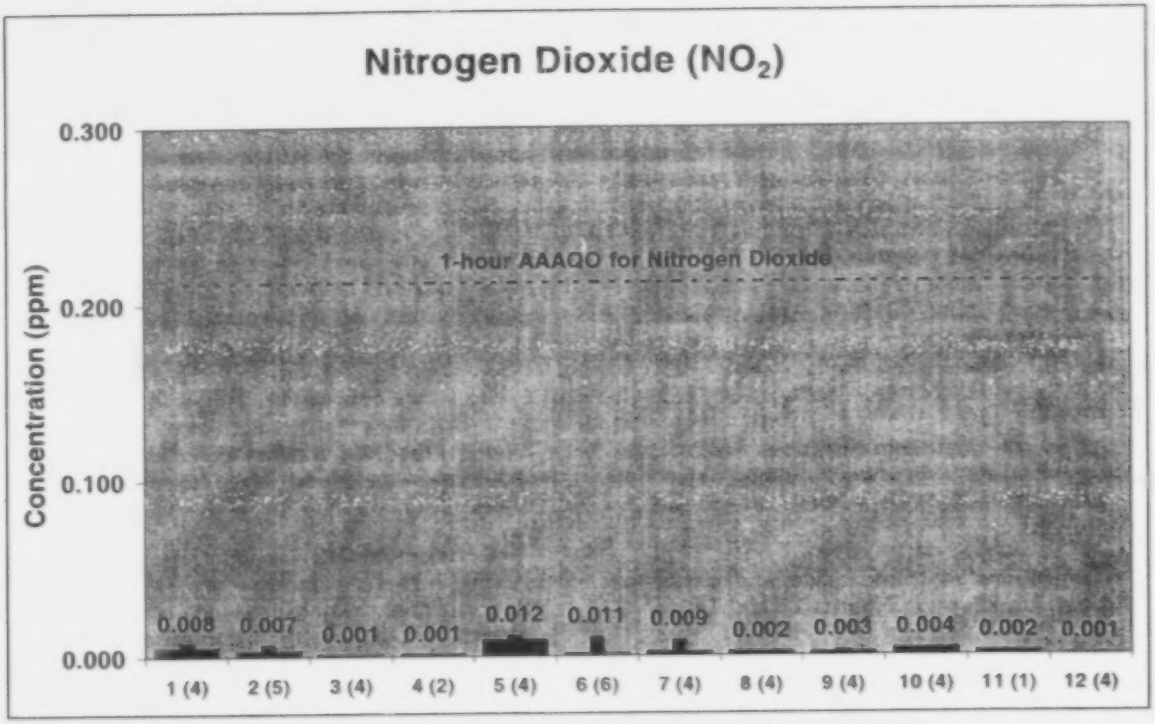


Figure 12: One-hour median and maximum concentrations for nitrogen dioxide

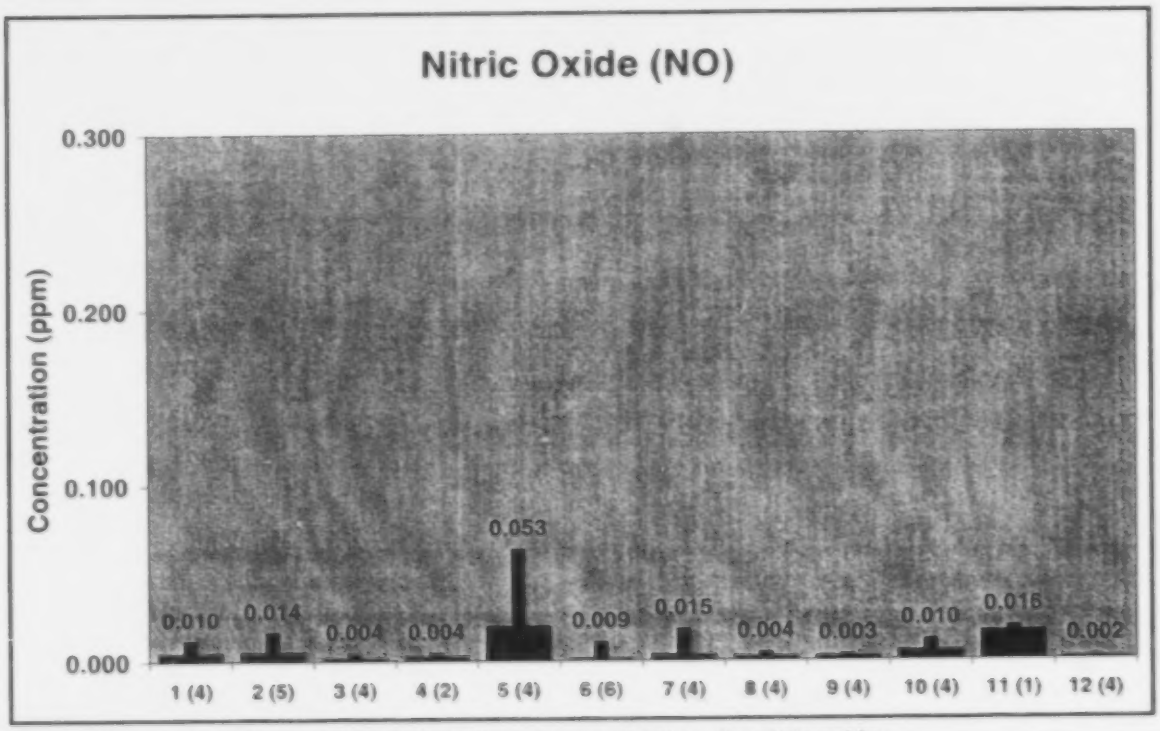


Figure 13: One-hour median and maximum concentrations for nitric oxide.

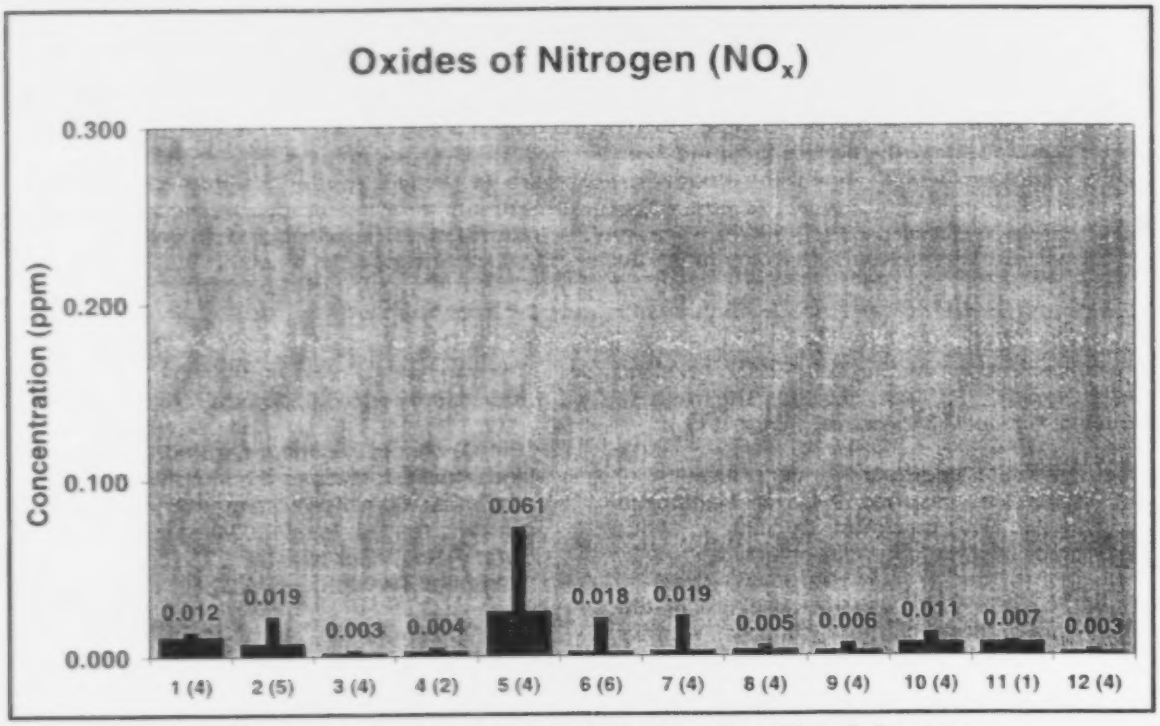


Figure 14: One-hour median and maximum concentrations for oxides of nitrogen.

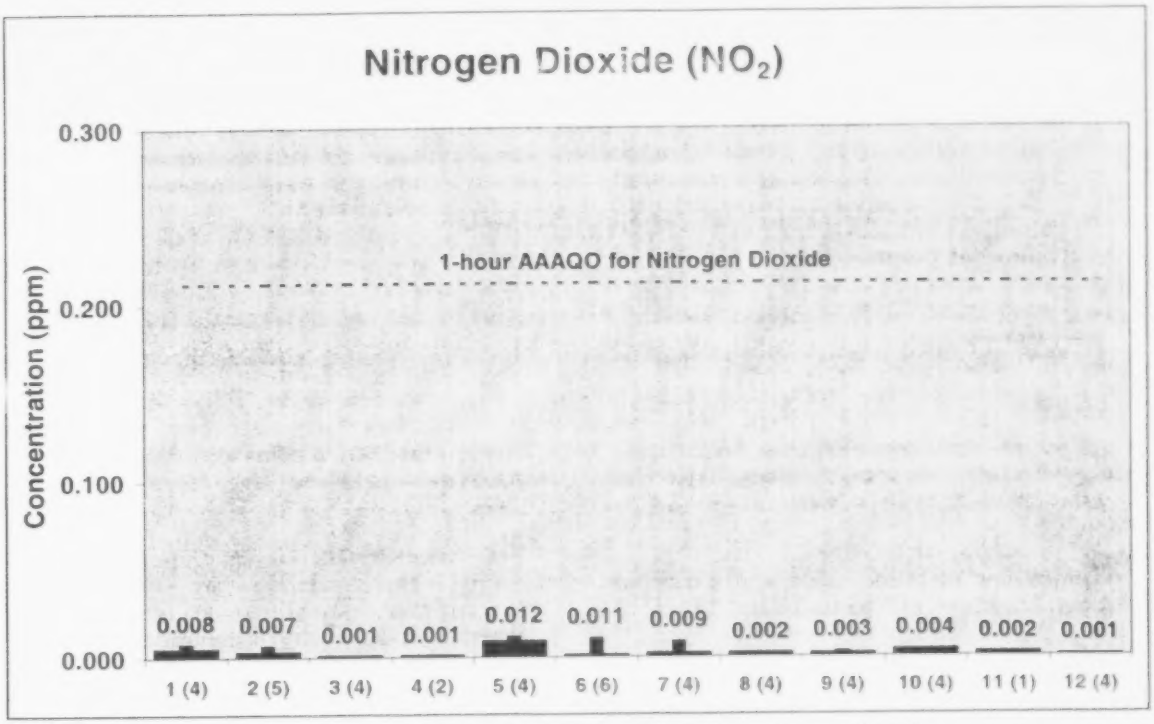
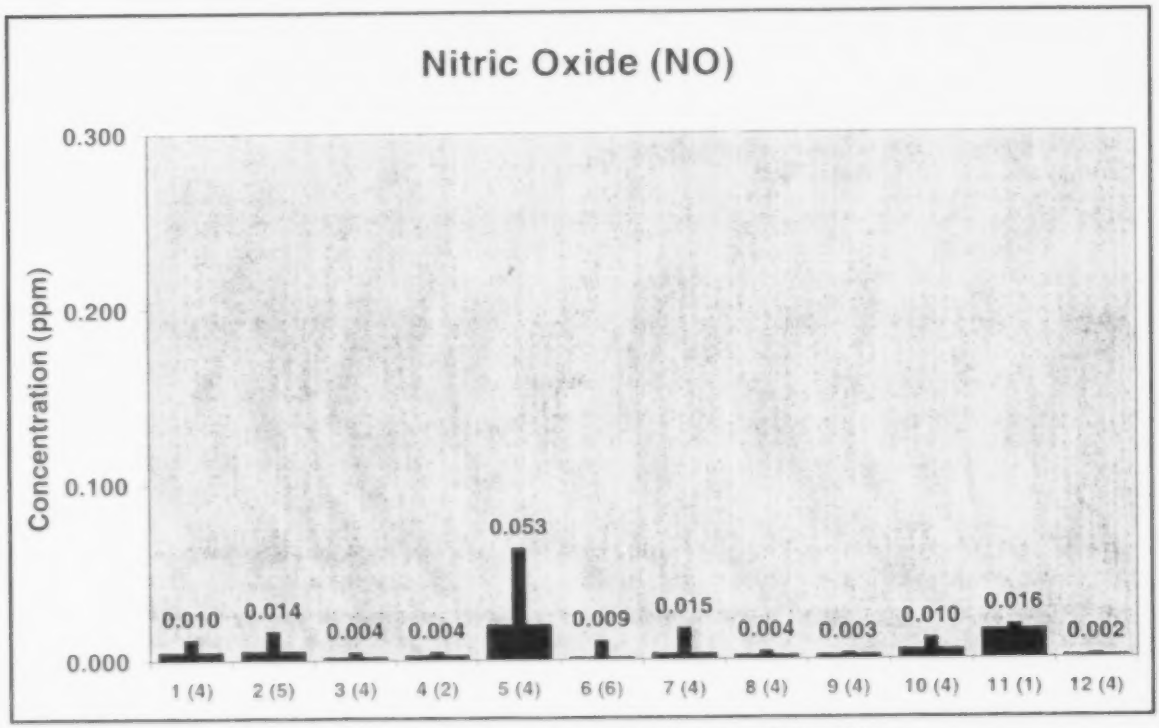


Figure 12: One-hour median and maximum concentrations for nitrogen dioxide



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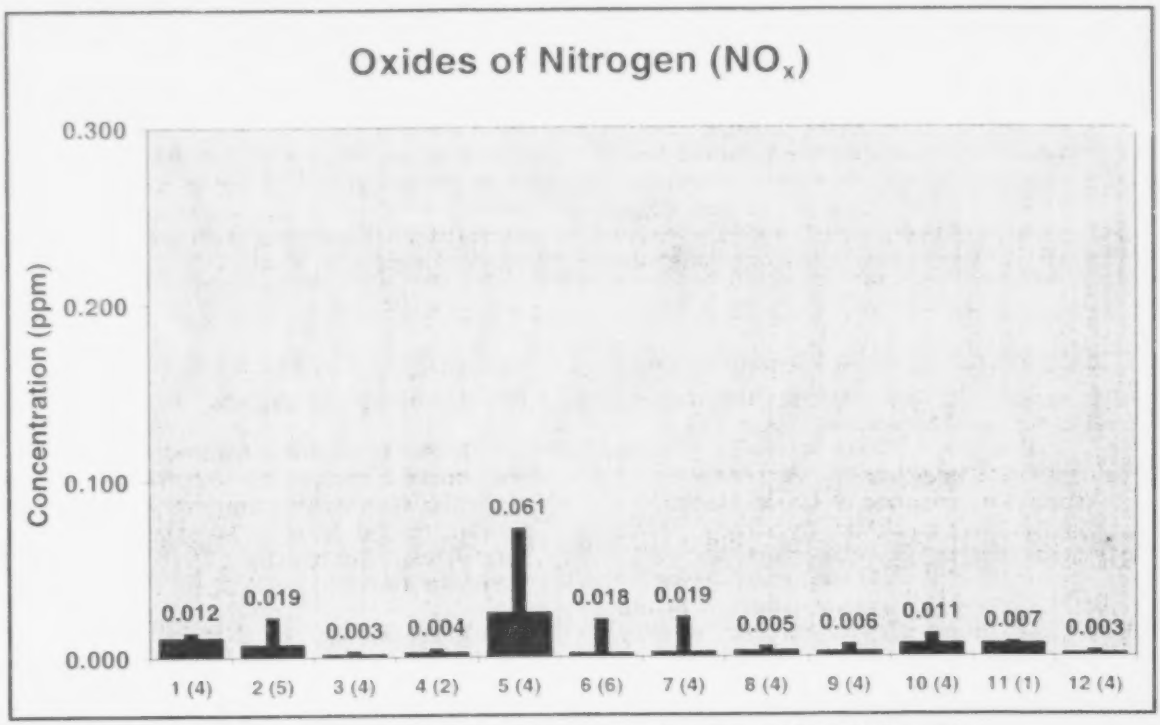

Figure 14: One-hour median and maximum concentrations for oxides of nitrogen.

Ozone (O_3)

Ozone in the lower atmosphere is produced by the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight, and transport of O_3 from the upper atmosphere to ground level. Transport from the upper atmosphere is likely the dominant ozone producing process in the fall, winter and early spring seasons. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide..

O_3 concentrations in the 2003-2004 Lakeland Area survey did not exceed the Alberta Ambient Air Quality objective (Figure 14).

The maximum one-hour O_3 concentration of 0.049 ppm was recorded at Devon Manatokan on May 28. This maximum O_3 value is about sixty percent of the one-hour objective.

Higher O_3 levels are usually observed in the afternoon because of more sunlight, warmer temperatures and more vertical mixing of the atmosphere. All of these factors can lead to higher O_3 concentrations.

The median O_3 concentration for the Lakeland Area survey was 0.031 ppm.

The O_3 concentrations measured in this survey are similar to results from previous surveys. Maximum O_3 concentrations from other MAML surveys ranged from 0.034 ppm (2003 Banff survey) to 0.059 ppm (2000/2001 Edmonton-Whitemud survey).

The maximum O_3 level measured at the permanent stations in Alberta was 0.094 ppm (Calgary Northwest) in 2003.

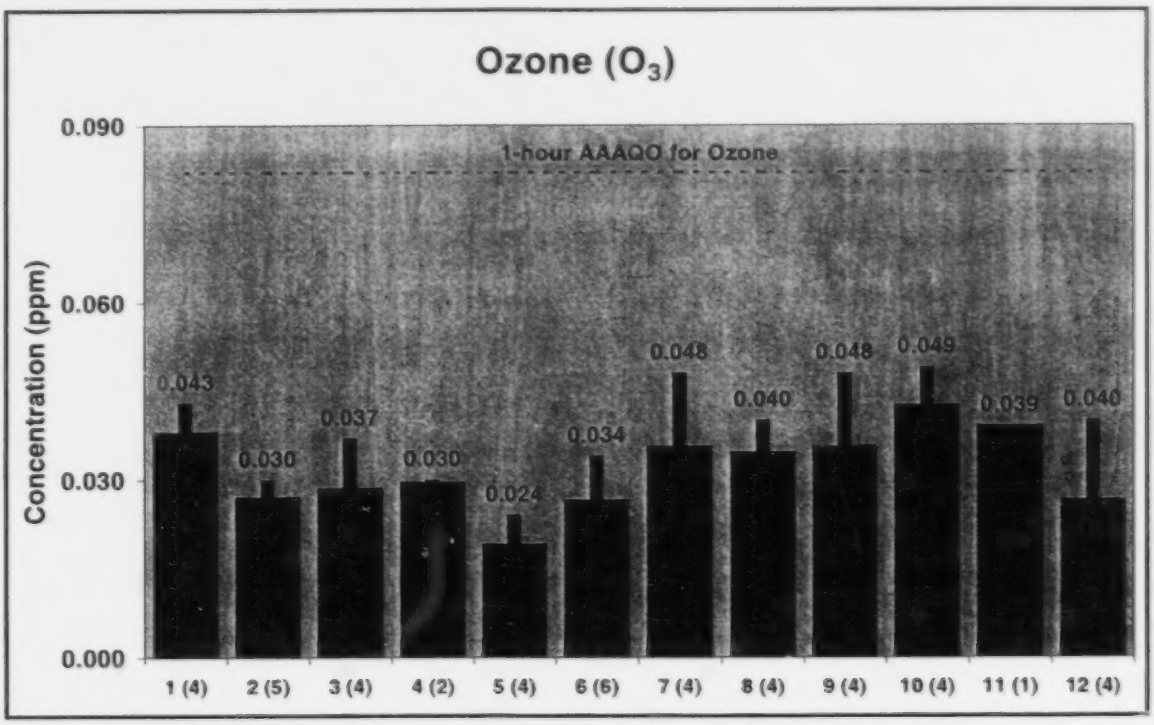

Figure 15: **One-hour median and maximum concentrations for ozone.**

Particulate Matter (TSP, PM_{10}, $PM_{2.5}$)

Total suspended particulates (TSP) refer to all particles up to 500 μm (micrometers) in diameter (a human hair is about 70μm in diameter) and are important primarily from a nuisance perspective. Particles less than 10 μm in diameter (PM_{10}) can be inhaled into the nose and throat while smaller particles, less than 2.5 μm in diameter ($PM_{2.5}$), can penetrate into the lungs. Sources of coarse particulate matter (PM10) include soil dust, resuspended road dust, agricultural dust (e.g., harvest), smoke from forest fires and wood burning. Fine particulate matter ($PM_{2.5}$) can originate in the atmosphere because of condensation processes and from combustion processes from sources such as vehicles emissions, industrial emissions, wood burning and forest fires.

Generally, higher levels of particulate matter occurred at locations with high traffic volumes such as Petrovera, Ardmore, Lac La Biche and Devon Manatokan, as shown in Figures 15, 16, and 17.

Maximum one-hour TSP, PM_{10} and $PM_{2.5}$ concentrations measured during the survey were 1505 $\mu g/m^3$, 1074 $\mu g/m^3$, and 127 $\mu g/m^3$, respectively. All of these concentrations were found at the Lac La Biche monitoring site during the Fall 2004 survey period. These relatively high concentrations of particulate matter may be attributed to resuspended road dust from passing vehicles; low wind speeds also may have hindered dispersion of the dust.

The overall median concentrations in the Lakeland Area survey for TSP, PM_{10} and $PM_{2.5}$ were 13.5 $\mu g/m^3$, 8.5 $\mu g/m^3$ and 1 $\mu g/m^3$, respectfully.

Concentrations of TSP and PM_{10} measured during this survey are generally lower than levels found in other surveys, while $PM_{2.5}$ concentrations were similar to concentrations measured in other surveys.

Maximum one-hour TSP concentrations from other MAML surveys ranged from 37 $\mu g/m^3$ (2003 Banff survey) to 2281 $\mu g/m^3$ (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour PM_{10} concentrations from other MAML surveys ranged from 23 $\mu g/m^3$ (2003 Banff survey) to 1188 $\mu g/m^3$ (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour $PM_{2.5}$ concentrations from other MAML surveys ranged from 21 $\mu g/m^3$ (2003 Banff survey) to 72 $\mu g/m^3$ (2001/2002 Cold Lake/Bonnyville survey).

The maximum one-hour PM_{10} and $PM_{2.5}$ levels measured in 2003 at the permanent stations in Alberta were 328 $\mu g/m^3$ (Edmonton Northwest) and 394 $\mu g/m^3$ (Fort Saskatchewan), respectively. TSP is not typically monitored at Alberta's permanent monitoring stations.

Ozone (O_3)

Ozone in the lower atmosphere is produced by the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight, and transport of O_3 from the upper atmosphere to ground level. Transport from the upper atmosphere is likely the dominant ozone producing process in the fall, winter and early spring seasons. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide..

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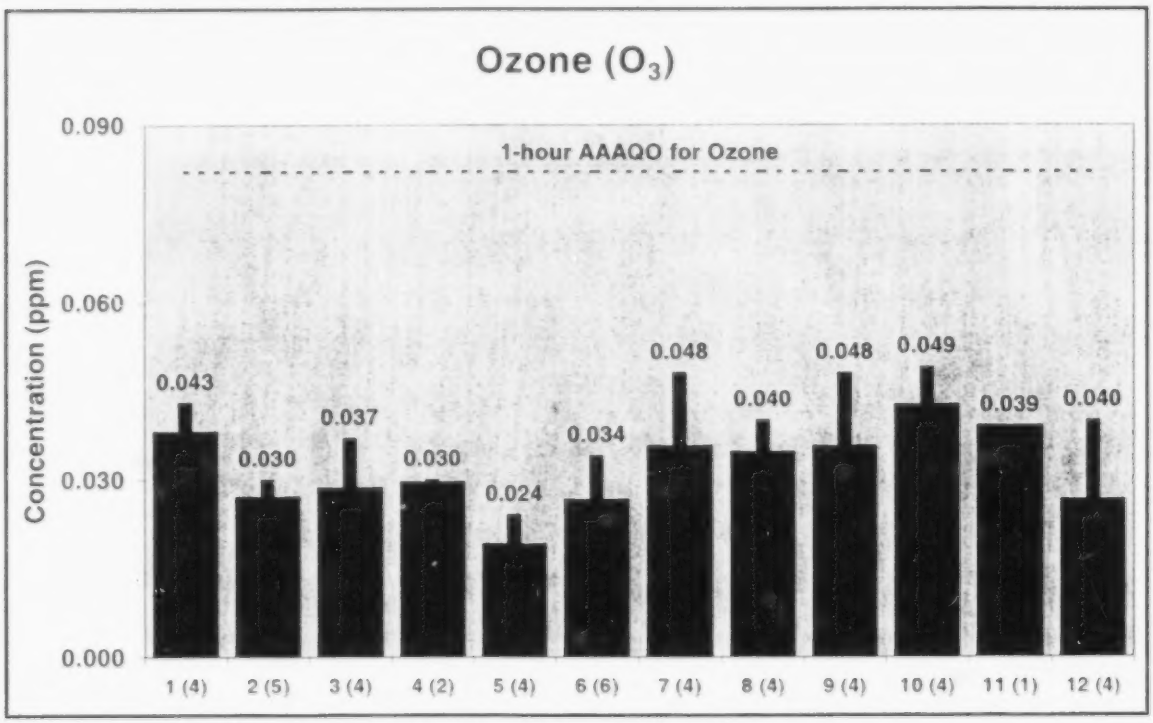

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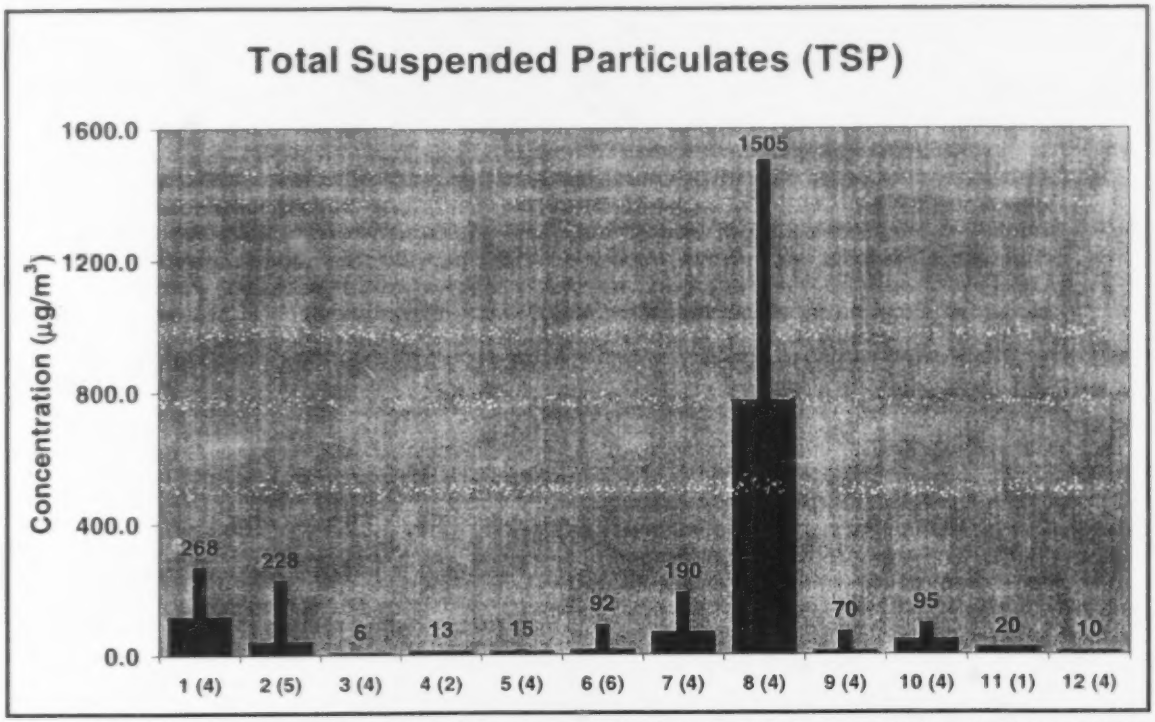

Figure 16: One-hour median and maximum concentrations for total suspended particulates (TSP).

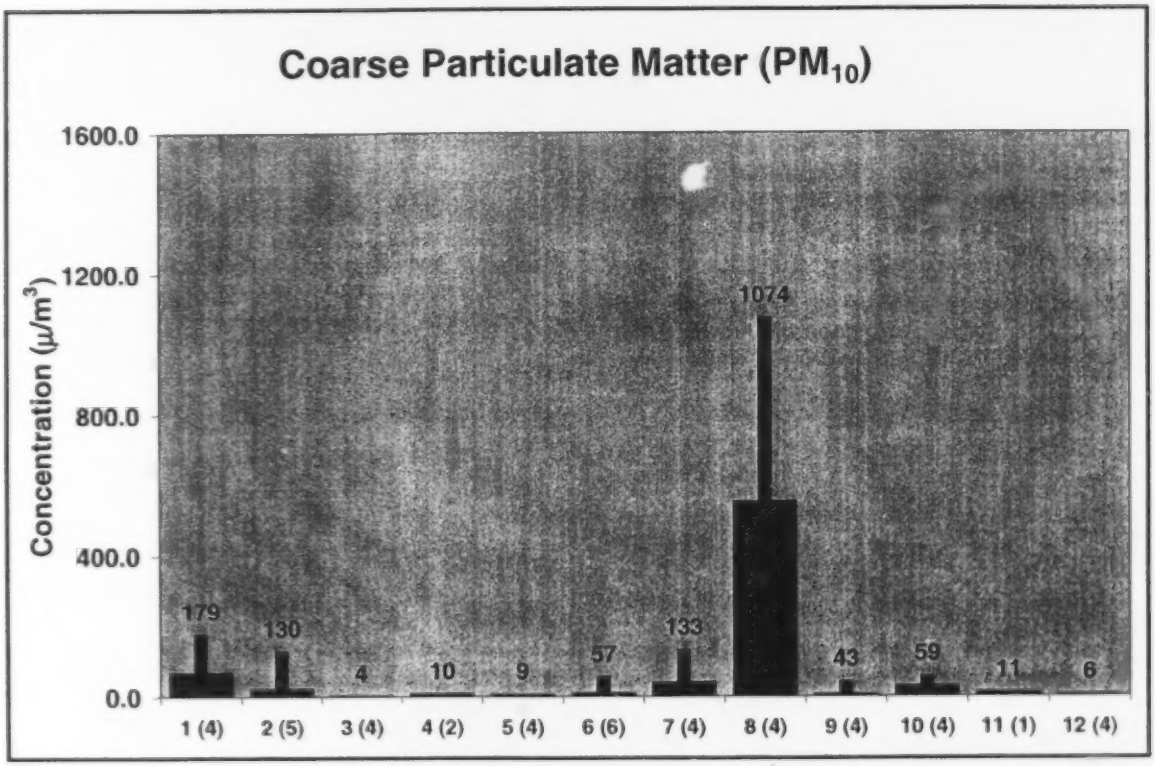

Figure 17: One-hour median and maximum concentrations for coarse particulate matter (PM_{10}).

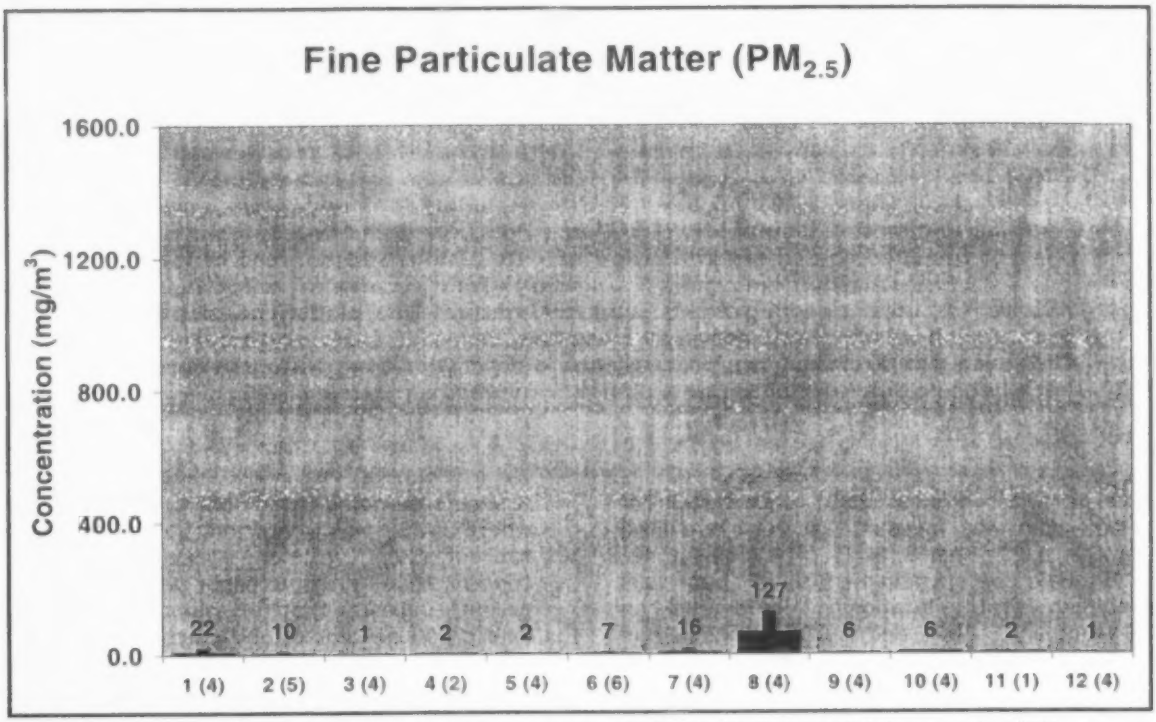

Figure 18: One-hour median and maximum concentrations for fine particulate matter ($PM_{2.5}$).

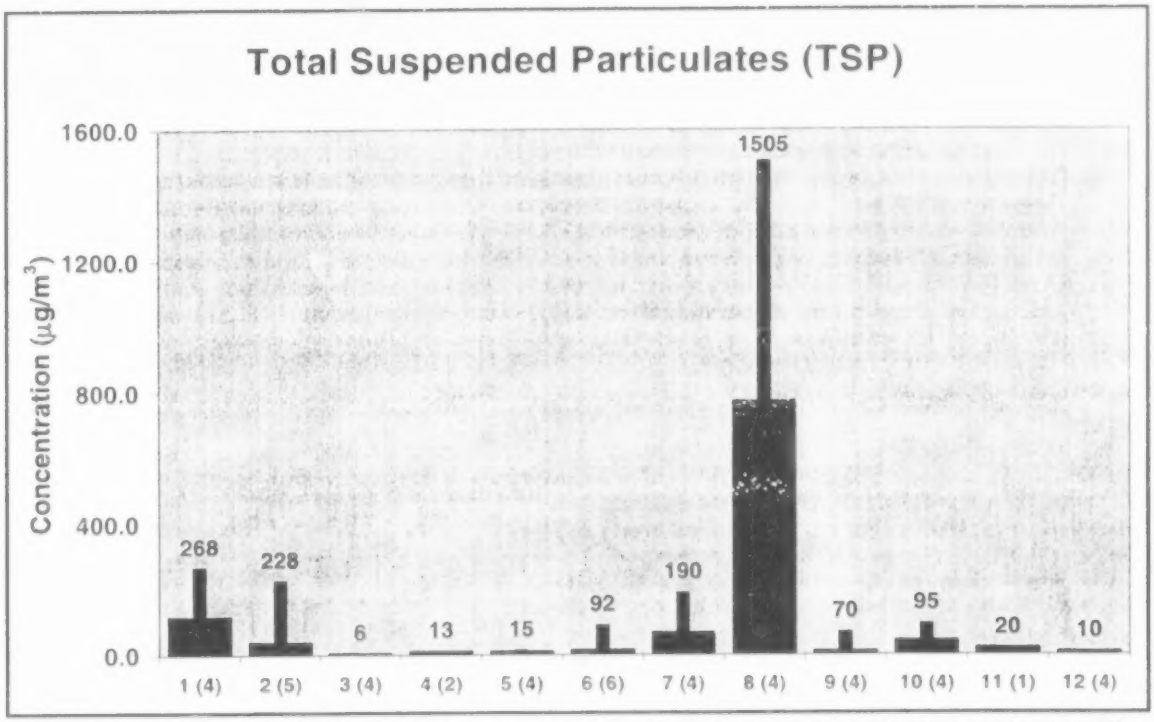

Figure 16: One-hour median and maximum concentrations for total suspended particulates (TSP).

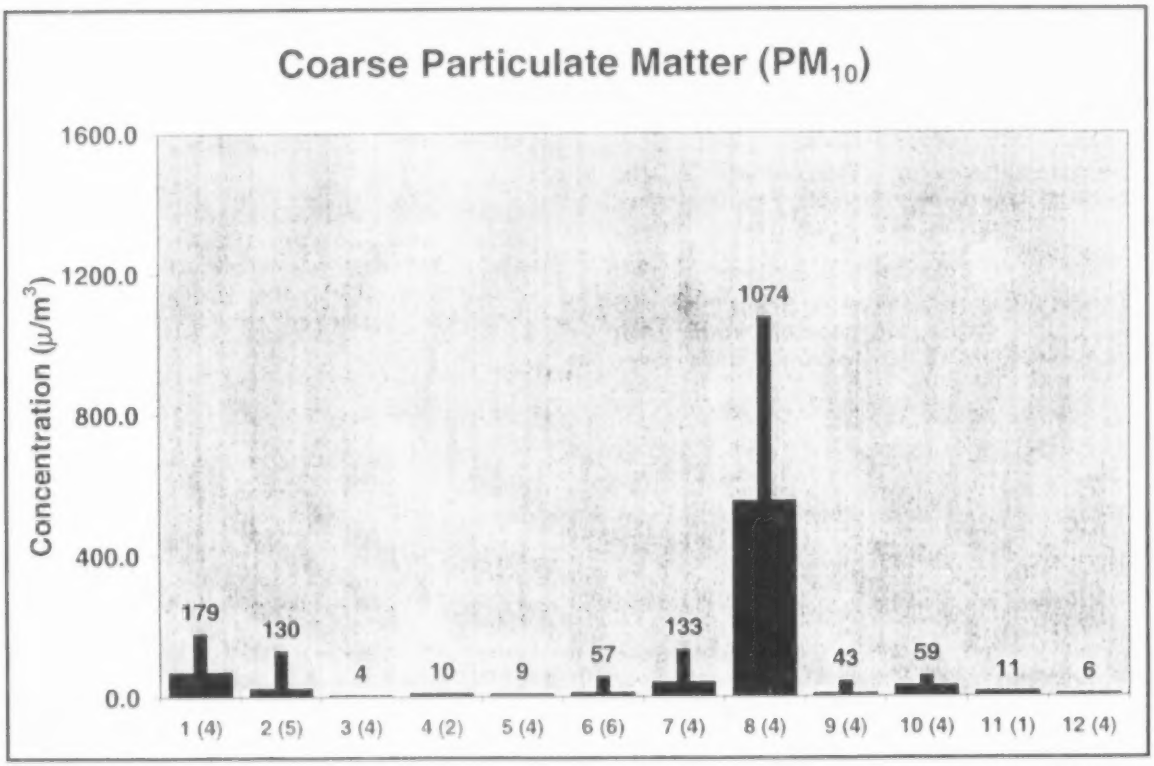

Figure 17: One-hour median and maximum concentrations for coarse particulate matter (PM_{10}).

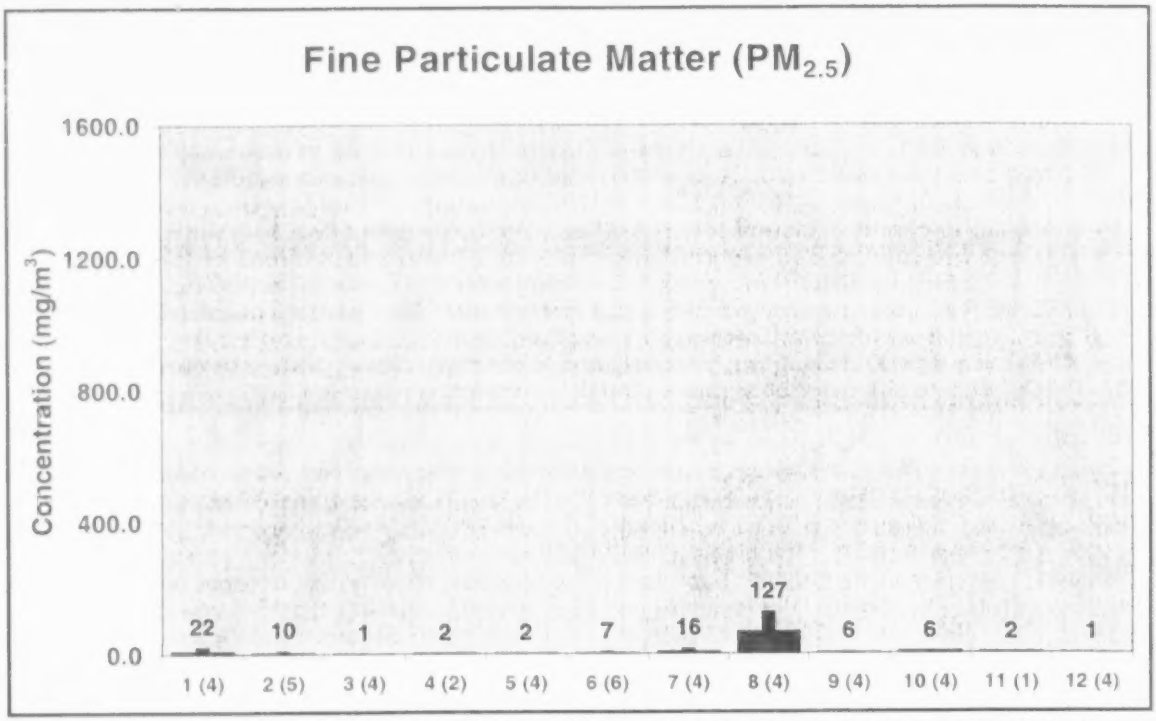

Figure 18: One-hour median and maximum concentrations for fine particlulate matter ($PM_{2.5}$).

Hydrogen Sulphide and Total Reduced Sulphur (H_2S and TRS)

Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of H_2S and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

The highest one-hour TRS concentration of 0.003 ppm was measured at Petrovera Frog Lake on September 8, 2003. The highest one-hour H_2S concentration of 0.003 ppm was detected two locations; Petrovera on September 8, 2003 and JACOS Hangingstone on May 31, 2004. These concentrations were likely from emissions during truck offloading operations.

The overall median concentrations in the 2003-2004 Lakeland Area survey for H_2S and TRS were both below the lower detection limit of the MAML's instruments.

Figures 18 and 19 show the median and maximum concentrations for H_2S and TRS, respectively, for this survey.

The H_2S and TRS concentrations measured were generally lower than or similar to levels found in other surveys, except for a small number of higher readings.

It should be noted that in only 2 of 9 locations where TRS was detected, was the TRS concentration greater than the H_2S concentration. From an odour perspective, this perhaps indicates that H_2S was contributing to nearly 100 percent of any perceptible sulphur compound odours in 7 of 9 locations.

Maximum one-hour concentrations for H_2S from other MAML surveys ranged from 0.001 ppm (2000/2001 Wabuman survey) to 0.054 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour concentrations for TRS from other MAML surveys ranged from 0.001 ppm (2003 Banff survey) to 0.056 ppm (2001/2002 Cold Lake/Bonnyville survey).

The maximum one-hour concentrations for H_2S and TRS monitored in 2003 at the permanent monitoring stations in Alberta were 0.046 ppm and 0.051 ppm (both at Caroline), respectively.

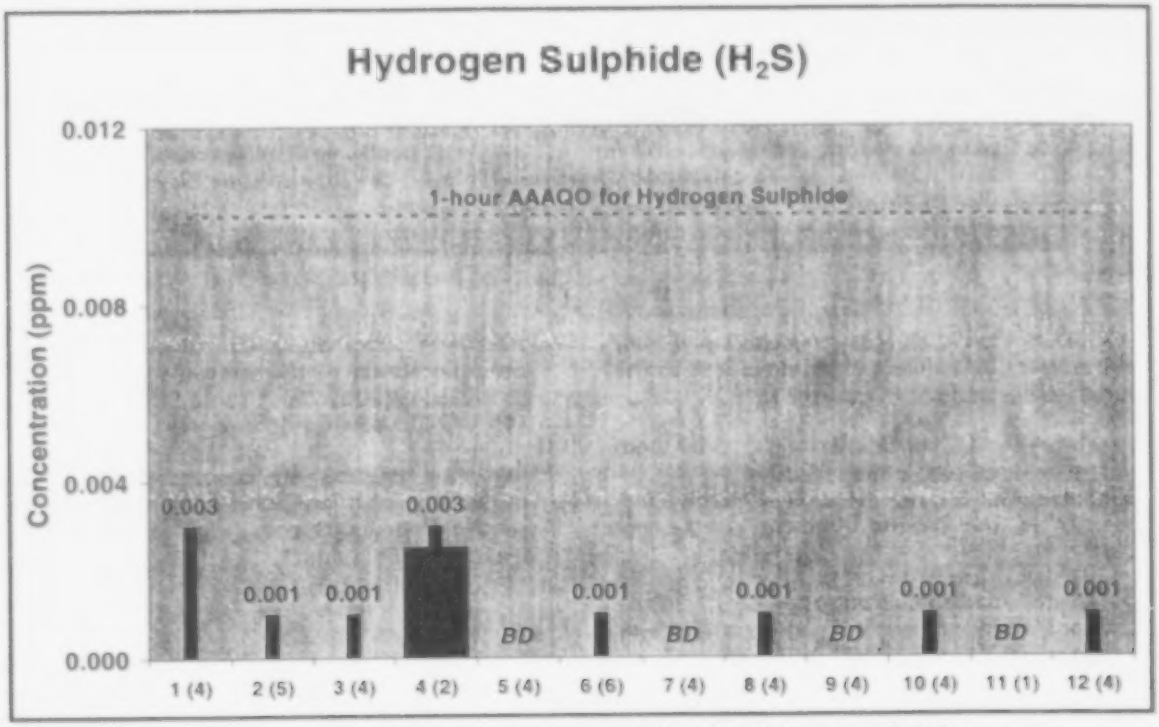

Figure 19: One-hour median and maximum concentrations for hydrogen sulphide

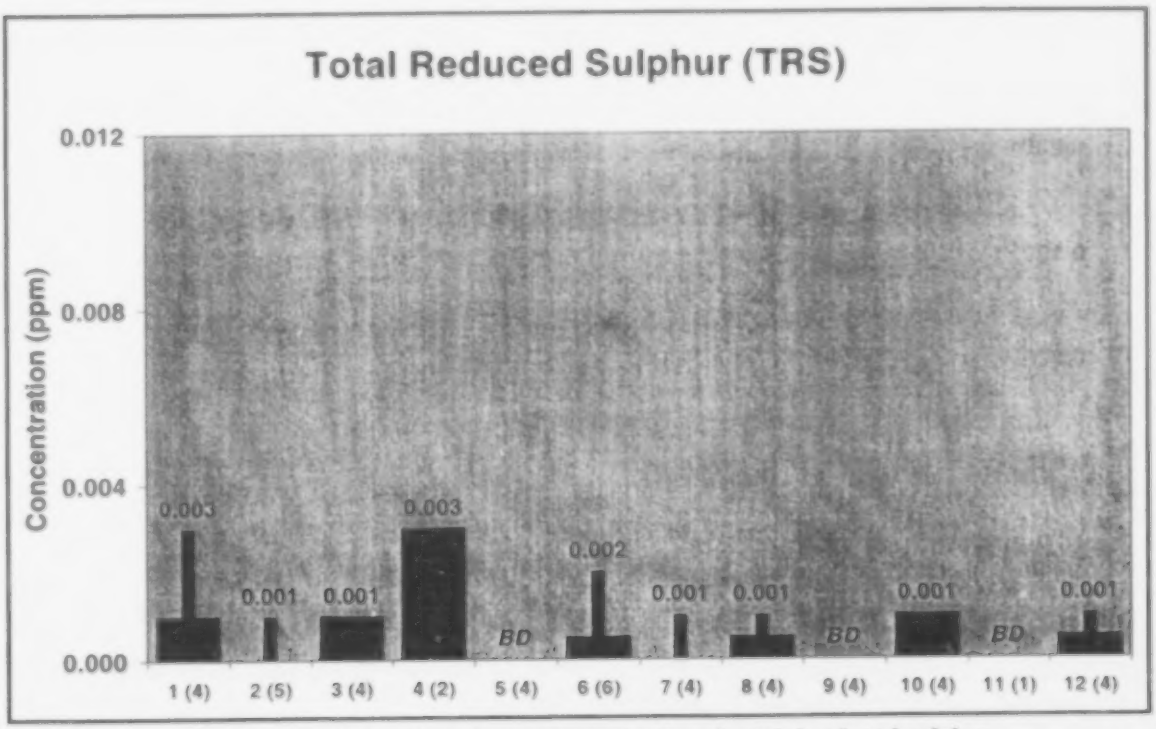

Figure 20: One-hour median and maximum concentrations for total reduced sulphur.

Hydrogen Sulphide and Total Reduced Sulphur (H_2S and TRS)

Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of H_2S and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

The highest one-hour TRS concentration of 0.003 ppm was measured at Petrovera Frog Lake on September 8, 2003. The highest one-hour H_2S concentration of 0.003 ppm was detected two locations; Petrovera on September 8, 2003 and JACOS Hangingstone on May 31, 2004. These concentrations were likely from emissions during truck offloading operations.

The overall median concentrations in the 2003-2004 Lakeland Area survey for H_2S and TRS were both below the lower detection limit of the MAML's instruments.

Figures 18 and 19 show the median and maximum concentrations for H_2S and TRS, respectively, for this survey.

The H_2S and TRS concentrations measured were generally lower than or similar to levels found in other surveys, except for a small number of higher readings.

It should be noted that in only 2 of 9 locations where TRS was detected, was the TRS concentration greater than the H_2S concentration. From an odour perspective, this perhaps indicates that H_2S was contributing to nearly 100 percent of any perceptible sulphur compound odours in 7 of 9 locations.

Maximum one-hour concentrations for H_2S from other MAML surveys ranged from 0.001 ppm (2000/2001 Wabuman survey) to 0.054 ppm (2001/2002 Cold Lake/Bonnyville survey).

Maximum one-hour concentrations for TRS from other MAML surveys ranged from 0.001 ppm (2003 Banff survey) to 0.056 ppm (2001/2002 Cold Lake/Bonnyville survey).

The maximum one-hour concentrations for H_2S and TRS monitored in 2003 at the permanent monitoring stations in Alberta were 0.046 ppm and 0.051 ppm (both at Caroline), respectively.

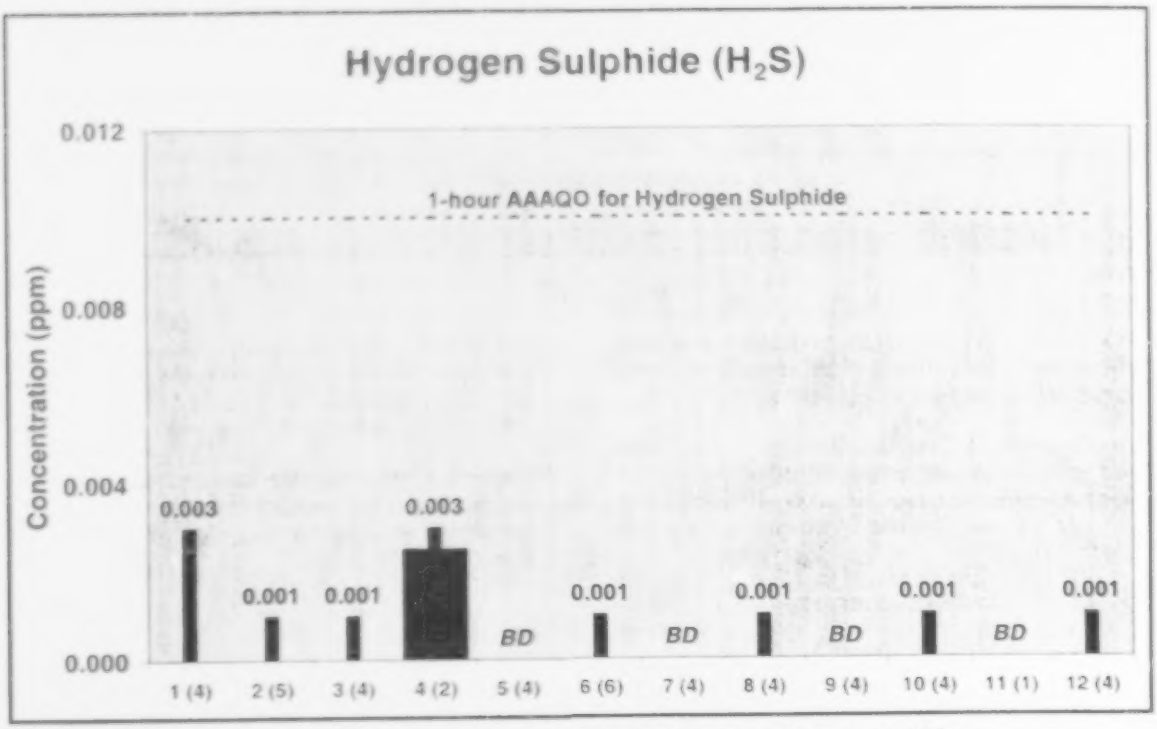

Figure 19: One-hour median and maximum concentrations for hydrogen sulphide

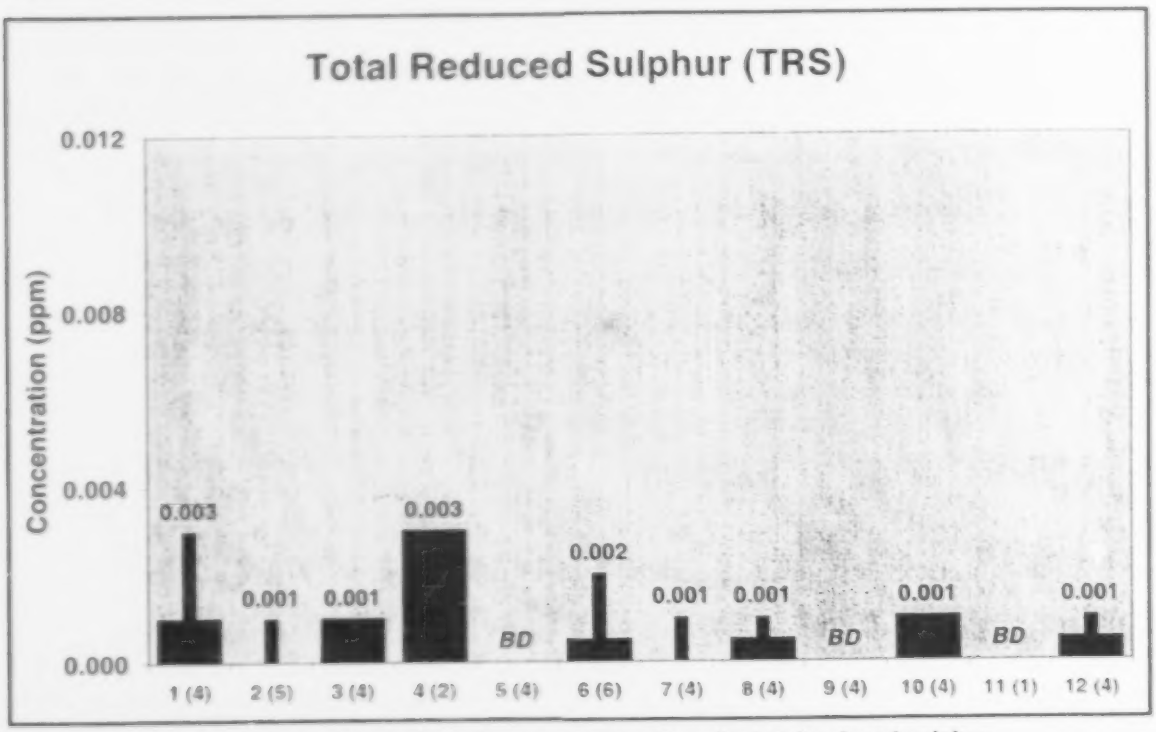

Figure 20: One-hour median and maximum concentrations for total reduced sulphur.

Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, it is estimated that 45% of SO_2 emissions are produced by natural gas processing plants while oil sands and power plants produce about 26% and 21% of SO_2 emissions, respectively[1]. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

SO_2 levels were well below Alberta's one-hour objective at all ambient sites monitored in the survey area, as seen in Figure 20.

The highest SO_2 concentration of 0.009 ppm was measured on May 31, 2004 at JACOS Hangingstone. This is approximately five percent of the Alberta Ambient Air Quality Objectives.

The overall median concentration of SO_2 in the Lakeland area survey was below the lower detection limit of the MAML's instruments.

SO_2 concentrations measured in the 2003-2004 Lakeland Area survey were similar to measurements made in previous surveys.

Maximum one-hour SO_2 concentrations in other locations in the province ranged from 0.002 ppm (2003 Banff survey) to 0.092 ppm (1999/2000 Bow Corridor survey).

Maximum one-hour SO_2 concentrations in 2003 at permanent monitoring stations in Alberta ranged from 0.009 ppm (Hightower Ridge) to 0.180 ppm (Mannix).

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[1] *Environment Canada. 1998. 1995 Criteria Air Contaminant Emissions Inventory Summaries. Pollution Data Branch, Environment Canada.*

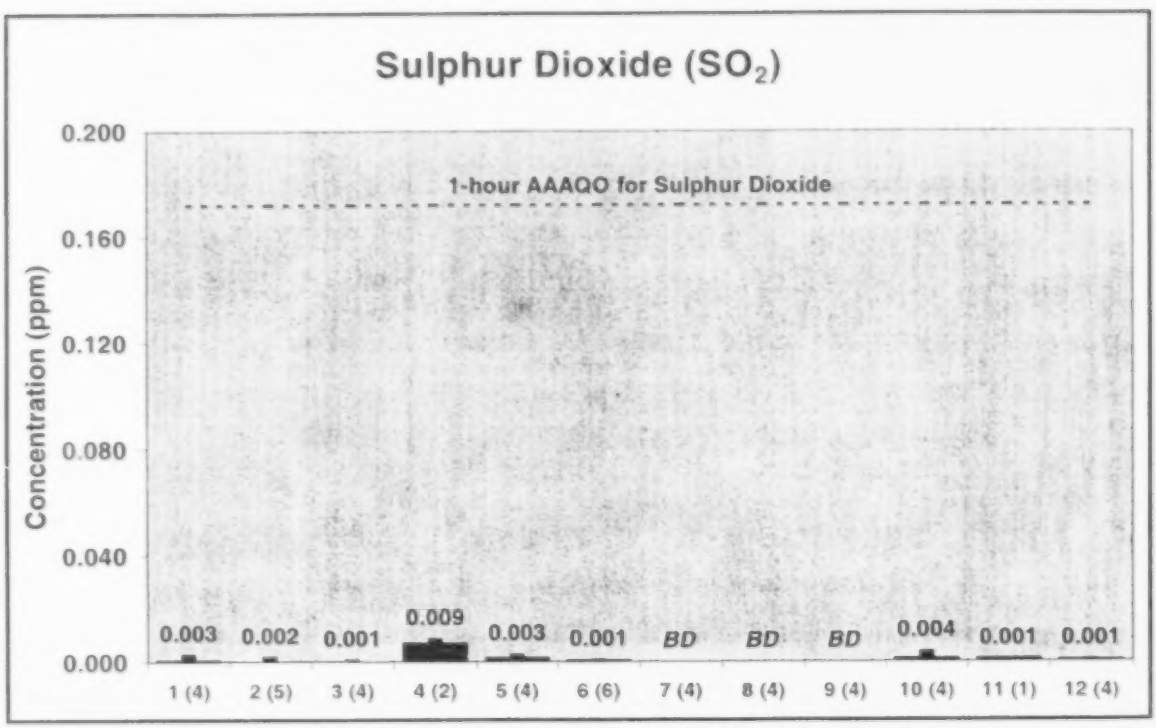

Figure 21: **One-hour median and maximum concentrations for sulphur dioxide.**

Sulphur Dioxide (SO_2)

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, it is estimated that 45% of SO_2 emissions are produced by natural gas processing plants while oil sands and power plants produce about 26% and 21% of SO_2 emissions, respectively[1]. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

SO_2 levels were well below Alberta's one-hour objective at all ambient sites monitored in the survey area, as seen in Figure 20.

The highest SO_2 concentration of 0.009 ppm was measured on May 31, 2004 at JACOS Hangingstone. This is approximately five percent of the Alberta Ambient Air Quality Objectives.

The overall median concentration of SO_2 in the Lakeland area survey was below the lower detection limit of the MAML's instruments.

SO_2 concentrations measured in the 2003-2004 Lakeland Area survey were similar to measurements made in previous surveys.

Maximum one-hour SO_2 concentrations in other locations in the province ranged from 0.002 ppm (2003 Banff survey) to 0.092 ppm (1999/2000 Bow Corridor survey).

Maximum one-hour SO_2 concentrations in 2003 at permanent monitoring stations in Alberta ranged from 0.009 ppm (Hightower Ridge) to 0.180 ppm (Mannix).

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[1] *Environment Canada. 1998. 1995 Criteria Air Contaminant Emissions Inventory Summaries. Pollution Data Branch, Environment Canada.*

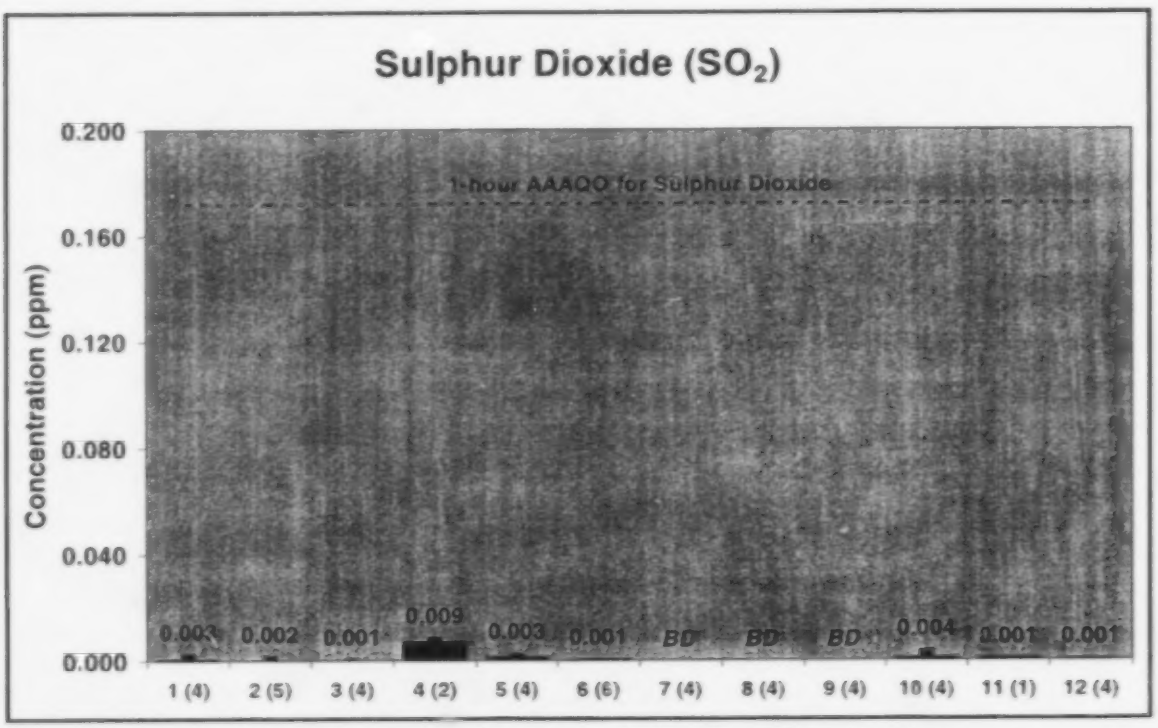

Figure 21: **One-hour median and maximum concentrations for sulphur dioxide.**

Appendix A

Monitoring Data

Table A1 **Median one-hour air pollutant ambient site concentrations for the 2003-2004 Lakeland Area survey.**

				Hydrocarbons				Oxides of Nitrogen				Particulates			Sulphur Compounds		
	Monitoring Location	NH_3	CO	CH_4	RHC	THC	PAH	NO_2	NO	NO_X	O_3	TSP	PM_{10}	$PM_{2.5}$	H_2S	TRS	SO_2
		ppm	ppm	ppm	ppm	ppm	ng/m³	ppm	ppm	ppm	ppm	µg/m³	µg/m³	µg/m³	ppm	ppm	ppm
1	Petrovera cleaning plant. LSD 32-55-3 W4M	0.007	0.4	3.5	1.0	4.2	1.9	0.005	0.005	0.011	0.038	116	68	7	bd	0.001	0.001
2	Conoco Philips. LSD 14-24-83-7 W4M	0.004	0.2	2.4	0.5	2.9	1.3	0.003	0.005	0.007	0.027	38	22	2	bd	bd	bd
3	St Paul. 53 St. and 50 Ave.	0.004	0.1	2.1	0.1	2.2	0.4	0.001	0.002	0.002	0.029	5	3	1	bd	0.001	bd
4	JACOS Hangingstone LSD 13-26-84-11 W4M	0.004	0.3	2.7	0.2	2.9	ND	0.001	0.003	0.003	0.030	11	8	2	0.003	0.003	0.007
5	OPTI/Nexen Long Lake. LSD 31-85-6 W4M	0.003	0.2	2.8	0.2	2.8	1.7	0.009	0.020	0.025	0.019	10	7	1	bd	bd	0.002
6	La Corey	bd	0.2	2.5	0.1	2.4	0.3	0.001	0.001	0.002	0.027	15	10	1	bd	0.001	0.001
7	Ardmore. Hwy 892, 200m North of Town	0.002	0.1	2.2	0.2	2.5	2.5	0.002	0.003	0.003	0.036	68	40	5	bd	bd	bd
8	Lac La Biche Provincial Building	bd	0.2	2.6	0.1	2.7	0.4	0.002	0.002	0.003	0.035	772	550	65	bd	0.001	bd
9	Riverhurst Hall. Hwy 55 and Range Road 31	0.001	0.1	2.1	0.1	2.2	1.3	0.002	0.002	0.003	0.036	10	7	1	bd	bd	bd
10	Devon Manatokan Plant. LSD 9-14-63 W4M	0.004	0.1	2.5	0.4	2.7	2.0	0.004	0.005	0.007	0.043	43	29	5	bd	0.001	0.001
11	Beaver Dam	0.007	0.2	3.2	0.0	3.2	0.2	0.002	0.016	0.007	0.039	20	11	2	bd	bd	0.001
12	Lake Eliza. Hwy 646 and Range Road 85	0.005	0.2	2.1	0.1	2.1	0.4	0.001	0.001	0.002	0.027	8	5	1	bd	0.001	0.001

ND - not determined (analyzer not functioning)
bd - below detection limit of analyzer

Table A2 Maximum one-hour air pollutant ambient site concentrations for the 2003-2004 Lakeland Area survey.

				Hydrocarbons				Oxides of Nitrogen				Particulates			Sulphur Compounds		
Monitoring Location		NH_3	CO	CH_4	RHC	THC	PAH	NO_2	NO	NO_X	O_3	TSP	PM_{10}	$PM_{2.5}$	H_2S	TRS	SO_2
		ppm	ppm	ppm	ppm	ppm	ng/m³	ppm	ppm	ppm	ppm	µg/m³	µg/m³	µg/m³	ppm	ppm	ppm
1	Petrovera cleaning plant. LSD 32-55-3 W4M	0.009	0.9	3.7	1.4	4.9	3.3	0.008	0.010	0.012	0.043	268	179	22	0.003	0.003	0.003
2	Conoco Philips. LSD 14-24-83-7 W4M	0.007	0.2	3.1	4.6	7.2	1.4	0.007	0.014	0.019	0.030	228	130	10	0.001	0.001	0.002
3	St Paul. 53 St. and 50 Ave.	0.008	0.2	2.4	0.2	2.5	2.3	0.001	0.004	0.003	0.037	6	4	1	0.001	0.001	0.001
4	JACOS Hangingstone LSD 13-26-84-11 W4M	0.007	0.3	2.8	0.2	2.9	0.0	0.001	0.004	0.004	0.030	13	10	2	0.003	0.003	0.009
5	OPTI/Nexen Long Lake. LSD 31-85-6 W4M	0.013	0.3	2.9	0.2	3.1	2.9	0.012	0.053	0.061	0.024	15	9	2	bd	bd	0.003
6	La Corey	0.007	0.4	3.5	0.5	3.3	14.1	0.011	0.009	0.018	0.034	92	57	7	0.001	0.002	0.001
7	Ardmore. Hwy 892, 200m North of Town	0.009	0.2	4.1	0.4	4.1	7.7	0.009	0.015	0.019	0.048	190	133	16	bd	0.001	bd
8	Lac La Biche Provincial Building	0.001	0.3	2.9	0.3	3.3	0.8	0.002	0.004	0.005	0.040	1505	1074	127	0.001	0.001	bd
9	Riverhurst Hall. Hwy 55 and Range Road 31	0.001	0.2	2.5	0.3	2.5	1.9	0.003	0.003	0.006	0.048	70	43	6	bd	bd	bd
10	Devon Manatokan Plant. LSD 9-14-63 W4M	0.006	0.1	2.5	0.7	2.8	4.8	0.004	0.010	0.011	0.049	95	59	6	0.001	0.001	0.004
11	Beaver Dam	0.007	0.2	3.2	bd	3.2	0.2	0.002	0.016	0.007	0.039	20	11	2	bd	bd	0.001
12	Lake Eliza. Hwy 646 and Range Road 85	0.010	0.7	2.4	0.1	2.5	0.6	0.001	0.002	0.003	0.040	10	6	1	0.001	0.001	0.001

ND - not determined (analyzer not functioning)
bd - below detection limit of analyzer

Table A1 **Median one-hour air pollutant ambient site concentrations for the 2003-2004 Lakeland Area survey.**

				Hydrocarbons				Oxides of Nitrogen				Particulates			Sulphur Compounds		
Monitoring Location		NH_3	CO	CH_4	RHC	THC	PAH	NO_2	NO	NO_x	O_3	TSP	PM_{10}	$PM_{2.5}$	H_2S	TRS	SO_2
		ppm	ppm	ppm	ppm	ppm	ng/m^3	ppm	ppm	ppm	ppm	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	ppm	ppm	ppm
1	Petrovera cleaning plant. LSD 32-55-3 W4M	0.007	0.4	3.5	1.0	4.2	1.9	0.005	0.005	0.011	0.038	116	68	7	bd	0.001	0.001
2	Conoco Philips. LSD 14-24-83-7 W4M	0.004	0.2	2.4	0.5	2.9	1.3	0.003	0.005	0.007	0.027	38	22	2	bd	bd	bd
3	St Paul. 53 St. and 50 Ave.	0.004	0.1	2.1	0.1	2.2	0.4	0.001	0.002	0.002	0.029	5	3	1	bd	0.001	bd
4	JACOS Hangingstone LSD 13-26-84-11 W4M	0.004	0.3	2.7	0.2	2.9	ND	0.001	0.003	0.003	0.030	11	8	2	0.003	0.003	0.007
5	OPTI/Nexen Long Lake. LSD 31-85-6 W4M	0.003	0.2	2.8	0.2	2.8	1.7	0.009	0.020	0.025	0.019	10	7	1	bd	bd	0.002
6	La Corey	bd	0.2	2.5	0.1	2.4	0.3	0.001	0.001	0.002	0.027	15	10	1	bd	0.001	0.001
7	Ardmore. Hwy 892, 200m North of Town	0.002	0.1	2.2	0.2	2.5	2.5	0.002	0.003	0.003	0.036	68	40	5	bd	bd	bd
8	Lac La Biche Provincial Building	bd	0.2	2.6	0.1	2.7	0.4	0.002	0.002	0.003	0.035	772	550	65	bd	0.001	bd
9	Riverhurst Hall. Hwy 55 and Range Road 31	0.001	0.1	2.1	0.1	2.2	1.3	0.002	0.002	0.003	0.036	10	7	1	bd	bd	bd
10	Devon Manatokan Plant. LSD 9-14-63 W4M	0.004	0.1	2.5	0.4	2.7	2.0	0.004	0.005	0.007	0.043	43	29	5	bd	0.001	0.001
11	Beaver Dam	0.007	0.2	3.2	0.0	3.2	0.2	0.002	0.016	0.007	0.039	20	11	2	bd	bd	0.001
12	Lake Eliza. Hwy 646 and Range Road 85	0.005	0.2	2.1	0.1	2.1	0.4	0.001	0.001	0.002	0.027	8	5	1	bd	0.001	0.001

ND – not determined (analyzer not functioning)
bd – below detection limit of analyzer

Table A2 **Maximum one-hour air pollutant ambient site concentrations for the 2003-2004 Lakeland Area survey.**

				Hydrocarbons				Oxides of Nitrogen				Particulates			Sulphur Compounds		
Monitoring Location		NH_3	CO	CH_4	RHC	THC	PAH	NO_2	NO	NO_X	O_3	TSP	PM_{10}	$PM_{2.5}$	H_2S	TRS	SO_2
		ppm	ppm	ppm	ppm	ppm	ng/m³	ppm	ppm	ppm	ppm	µg/m³	µg/m³	µg/m³	ppm	ppm	ppm
1	Petrovera cleaning plant. LSD 32-55-3 W4M	0.009	0.9	3.7	1.4	4.9	3.3	0.008	0.010	0.012	0.043	268	179	22	0.003	0.003	0.003
2	Conoco Philips. LSD 14-24-83-7 W4M	0.007	0.2	3.1	4.6	7.2	1.4	0.007	0.014	0.019	0.030	228	130	10	0.001	0.001	0.002
3	St Paul. 53 St. and 50 Ave.	0.008	0.2	2.4	0.2	2.5	2.3	0.001	0.004	0.003	0.037	6	4	1	0.001	0.001	0.001
4	JACOS Hangingstone LSD 13-26-84-11 W4M	0.007	0.3	2.8	0.2	2.9	0.0	0.001	0.004	0.004	0.030	13	10	2	0.003	0.003	0.009
5	OPTI/Nexen Long Lake. LSD 31-85-6 W4M	0.013	0.3	2.9	0.2	3.1	2.9	0.012	0.053	0.061	0.024	15	9	2	bd	bd	0.003
6	La Corey	0.007	0.4	3.5	0.5	3.3	14.1	0.011	0.009	0.018	0.034	92	57	7	0.001	0.002	0.001
7	Ardmore. Hwy 892, 200m North of Town	0.009	0.2	4.1	0.4	4.1	7.7	0.009	0.015	0.019	0.048	190	133	16	bd	0.001	bd
8	Lac La Biche Provincial Building	0.001	0.3	2.9	0.3	3.3	0.8	0.002	0.004	0.005	0.040	1505	1074	127	0.001	0.001	bd
9	Riverhurst Hall. Hwy 55 and Range Road 31	0.001	0.2	2.5	0.3	2.5	1.9	0.003	0.003	0.006	0.048	70	43	6	bd	bd	bd
10	Devon Manatokan Plant. LSD 9-14-63 W4M	0.006	0.1	2.5	0.7	2.8	4.8	0.004	0.010	0.011	0.049	95	59	6	0.001	0.001	0.004
11	Beaver Dam	0.007	0.2	3.2	bd	3.2	0.2	0.002	0.016	0.007	0.039	20	11	2	bd	bd	0.001
12	Lake Eliza. Hwy 646 and Range Road 85	0.010	0.7	2.4	0.1	2.5	0.6	0.001	0.002	0.003	0.040	10	6	1	0.001	0.001	0.001

ND – not determined (analyzer not functioning)
bd – below detection limit of analyzer

Table A3 Median one-hour air pollutant concentrations in Alberta.

Air Quality Station	Station or Survey Type	Monitoring Period	CO ppm	O_3 ppm	THC ppm	CH_4 ppm	RHC ppm	SO_2 ppm	NO_2 ppm	NH_3 ppm	TRS ppm	H_2S ppm	TSP µg/m³	PM_{10} µg/m³	$PM_{2.5}$ µg/m³	PAHs ng/m³
Lakeland Area[1] (current)	mobile survey	May 2003 to Sep. 2004	0.2	0.031	2.6	2.4	0.2	bd	0.002	0.002	bd	bd	14	9	1	bd
Banff[1]	mobile survey	Nov. 19 to 22, 2003	0.5	0.018	2.7	2.5	0.2	0.000	0.008	0.004	0.000	0.001	7	5	1	11
Fort Saskatchewan/Redwater1	mobile survey	May 2001 to Mar. 2002	0.3	0.029	2.1	2.1	0.1	0.001	0.004	0.001	bd	bd	39	22	3	bd
Cold Lake/Bonnieville/Elk Point[1]	mobile survey	Mar. 2001 to Feb. 2002	0.2	0.031	2.1	1.9	0.1	0.000	0.003	0.000	0.001	0.000	16	10	2	1
Whitecourt/Swan Hills/Shiningbank Lake[1]	mobile survey	Mar. 2001 to June 2001	0.2	0.027	2.3	2.0	0.3	0.004	0.005	0.001	0.001	0.000	47	29	4	1
Wabuman[1]	mobile survey	July 2000 to Sep. 2001	0.2	0.027	2.0	1.9	0.1	0.002	0.005	0.004	0.000	0.000	34	22	3	1
Edmonton (Whitemud Drive)[1]	mobile survey	June 2000 to July 2001	0.4	0.019	2.2	2.0	0.1	0.002	0.014	0.00.	0.000	0.000	41	24	3	8
Bow Corridor[1]	mobile survey	Dec. 1999 to Sep. 2000	0.2	0.030	1.9	1.8	0.1	0.001	0.007	0.001	0.001	0.000	74	40	4	4
Permanent Continuous Monitoring Stations																
Beaverlodge[2]	rural	Jan. 2003 to Dec. 2003	n/a	0.027	n/a	n/a	n/a	0.000	0.004	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Calgary Central[2]	urban	Jan. 2003 to Dec. 2003	0.4	0.015	2.1	n/a	n/a	n/a	0.025	n/a	n/a	n/a	n/a	18	5	n/a
Calgary East[2]	urban	Jan. 2003 to Dec. 2003	0.5	0.015	2.1	n/a	n/a	0.002	0.024	n/a	n/a	0.001	n/a	n/a	7	n/a
Calgary Northwest[2]	urban	Jan. 2003 to Dec. 2003	0.3	0.024	2.0	n/a	n/a	n/a	0.015	n/a	n/a	n/a	n/a	n/a	4	n/a
Edmonton Central[2]	urban	Jan. 2003 to Dec. 2003	0.5	0.016	2.2	n/a	n/a	n/a	0.023	n/a	n/a	n/a	n/a	n/a	5	n/a
Edmonton East[2]	urban	Jan. 2003 to Dec. 2003	0.3	0.022	2.2	n/a	n/a	0.00	0.014	n/a	n/a	0.000	n/a	n/a	5	n/a
Edmonton Northwest[2]	urban	Jan. 2003 to Dec. 2003	0.4	0.021	2.0	n/a	n/a	n/a	0.020	n/a	n/a	n/a	n/a	17	6	n/a
Fort Saskatchewan[2]	small urban	Jan. 2003 to Dec. 2003	3.8	0.023	1.9	n/a	n/a	0.001	0.008	0.001	n/a	bd	n/a	n/a	4	n/a
Red Deer[2]	small urban	Jan. 2003 to Dec. 2003	0.3	0.021	2.1	n/a	n/a	0.000	0.011	n/a	n/a	0.000	n/a	n/a	4	n/a
Buffalo Viewpoint[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	1.9	n/a	n/a	0.000	n/a	n/a	n/a	0.000	n/a	n/a	n/a	n/a
Fort Chipewyan[3]	rural	Jan. 2003 to Dec. 2003	n/a	0.065	n/a	n/a	n/a	0.018	0.030	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Fort McKay[3]	rural	Jan. 2003 to Dec. 2003	n/a	0.022	1.8	n/a	n/a	0.000	0.035	n/a	0.001	n/a	n/a	n/a	3	n/a
Fort McMurray (Athabasca Valley)[3]	small urban	Jan. 2003 to Dec. 2003	0.2	0.018	3.5	n/a	n/a	0.000	0.080	n/a	0.001	n/a	n/a	n/a	3	n/a
Fort McMurray (Patricia McInnes)[3]	small urban	Jan. 2003 to Dec. 2003	n/a	0.023	1.9	n/a	n/a	0.000	0.003	n/a	0.000	n/a	n/a	n/a	2	n/a
Mannix[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	1.9	n/a	n/a	0.001	n/a	n/a	n/a	0.000	n/a	n/a	n/a	n/a
Mildred Lake[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	2.1	n/a	n/a	0.001	n/a	n/a	n/a	0.000	n/a	n/a	n/a	n/a
Carrot Creek[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.029	n/a	n/a	n/a	0.001	0.006	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hightower Ridge[4]	background	Jan. 2003 to Dec. 2003	n/a	0.044	n/a	n/a	n/a	0.000	0.000	n/a	n/a	n/a	n/a	5	2	n/a
Steeper[4]	rural	Jan. 2003 to Dec. 2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Tomahawk[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.031	n/a	n/a	n/a	0.001	0.003	n/a	n/a	n/a	n/a	9	3	n/a
Violet Grove[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.034	2.0	n/a	n/a	0.001	0.002	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sherwood Park[5]	small urban	Jan. 2003 to Dec. 2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Caroline[6]	rural	Jan. 2003 to Dec. 2003	n/a	0.034	2.2	0.0	n/a	0.000	0.003	n/a	0.000	0.000	n/a	n/a	n/a	n/a

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n/a - Parameter not monitored or data not available.
bd - Below lower detection limit of analyzer

Table A4 Maximum one-hour air pollutant concentrations in Alberta.

Air Quality Station	Station or Survey Type	Monitoring Period	CO ppm	O_3 ppm	THC ppm	CH_4 ppm	RHC ppm	SO_2 ppm	NO_2 ppm	NH_3 ppm	TRS ppm	H_2S ppm	TSP $\mu g/m^3$	PM_{10} $\mu g/m^3$	$PM_{2.5}$ $\mu g/m^3$	PAHs ng/m^3
Lakeland Area[1] (current)	mobile survey	May 2003 to Sep. 2004	0.9	0.049	7.2	4.1	4.6	0.009	0.012	0.013	0.003	0.003	1505	1074	127	14
Banff[1]	mobile survey	Nov. 19 to 22, 2003	1.5	0.034	3.6	3.1	0.8	0.002	0.033	0.013	0.001	0.003	37	23	21	105
Fort Saskatchewan/Redwater1	mobile survey	May 2001 to Mar. 2002	2.2	0.049	3.6	3.6	0.5	0.022	0.051	0.577	0.004	0.003	547	323	24	70
Cold Lake/Bonnieville/Elk Point[1]	mobile survey	Mar. 2001 to Feb. 2002	1.4	0.047	9.7	4.6	7.1	0.017	0.014	0.005	0.056	0.054	2281	1188	72	14
Whitecourt/Swan Hills/Shiningbank Lake[1]	mobile survey	Mar. 2001 to June 2001	0.7	0.054	4.3	2.5	2.5	0.046	0.030	0.013	0.005	0.003	946	441	43	113
Waburman[1]	mobile survey	July 2000 to Sep. 2001	0.5	0.057	3.3	3.2	0.5	0.032	0.015	0.020	0.003	0.001	807	534	42	11
Edmonton (Whitemud Drive)[1]	mobile survey	June 2000 to July 2001	2.7	0.059	4.4	2.7	1.6	0.015	0.041	0.039	0.005	0.003	459	239	37	77
Bow Corridor[1]	mobile survey	Dec. 1999 to Sep. 2000	1.1	0.056	7.8	2.2	6.6	0.092	0.031	0.034	0.004	0.002	2082	1094	60	36
Permanent Continuous Monitoring Stations																
Beaverlodge[2]	rural	Jan. 2003 to Dec. 2003	n/a	0.060	n/a	n/a	n/a	0.080	0.038	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Calgary Central[2]	urban	Jan. 2003 to Dec. 2003	5.2	0.072	4.0	n/a	n/a	n/a	0.087	n/a	n/a	n/a	n/a	243	204	n/a
Calgary East[2]	urban	Jan. 2003 to Dec. 2003	5.4	0.072	5.3	n/a	n/a	0.022	0.114	n/a	n/a	0.018	n/a	n/a	224	n/a
Calgary Northwest[2]	urban	Jan. 2003 to Dec. 2003	3.4	0.094	3.3	n/a	n/a	n/a	0.065	n/a	n/a	n/a	n/a	n/a	208	n/a
Edmonton Central[2]	urban	Jan. 2003 to Dec. 2003	6.5	0.076	5.2	n/a	n/a	n/a	0.089	n/a	n/a	n/a	n/a	n/a	82	n/a
Edmonton East[2]	urban	Jan. 2003 to Dec. 2003	2.3	0.084	14.7	n/a	n/a	0.07	0.082	n/a	n/a	0.016	n/a	n/a	250	n/a
Edmonton Northwest[2]	urban	Jan. 2003 to Dec. 2003	5.9	0.091	6.1	n/a	n/a	n/a	0.109	n/a	n/a	n/a	n/a	328	97	n/a
Fort Saskatchewan[2]	small urban	Jan. 2003 to Dec. 2003	3.1	0.085	7.8	n/a	n/a	0.056	0.082	0.121	n/a	0.008	n/a	n/a	132	n/a
Red Deer[2]	small urban	Jan. 2003 to Dec. 2003	3.6	0.086	7.4	n/a	n/a	0.018	0.068	n/a	n/a	0.005	n/a	n/a	73	n/a
Buffalo Viewpoint[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	6.3	n/a	n/a	0.102	n/a	n/a	n/a	0.023	n/a	n/a	n/a	n/a
Fort Chipewyan[3]	rural	Jan. 2003 to Dec. 2003	n/a	0.063	n/a	n/a	n/a	0.020	0.043	n/a	n/a	n/a	n/a	n/a	49	n/a
Fort McKay[3]	rural	Jan. 2003 to Dec. 2003	n/a	0.084	11.1	n/a	n/a	0.095	0.035	n/a	0.008	n/a	n/a	n/a	81	n/a
Fort McMurray (Athabasca Valley)[3]	small urban	Jan. 2003 to Dec. 2003	2.9	0.063	3.7	n/a	n/a	0.044	0.063	n/a	0.007	n/a	n/a	n/a	48	n/a
Fort McMurray (Patricia McInnes)[3]	small urban	Jan. 2003 to Dec. 2003	n/a	0.059	3.0	n/a	n/a	0.048	0.040	n/a	0.005	n/a	n/a	n/a	63	n/a
Mannix[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	7.0	n/a	n/a	0.180	n/a	n/a	n/a	0.028	n/a	n/a	n/a	n/a
Mildred Lake[3]	industrial	Jan. 2003 to Dec. 2003	n/a	n/a	9.6	n/a	n/a	0.147	n/a	n/a	n/a	0.014	n/a	n/a	n/a	n/a
Carrot Creek[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.076	n/a	n/a	n/a	0.000	0.155	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hightower Ridge[4]	background	Jan. 2003 to Dec. 2003	n/a	0.067	n/a	n/a	n/a	0.009	0.014	n/a	n/a	n/a	n/a	84	77	n/a
Steeper[4]	rural	Jan. 2003 to Dec. 2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Tomahawk[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.083	n/a	n/a	n/a	0.038	0.032	n/a	n/a	n/a	n/a	149	56	n/a
Violet Grove[4]	rural	Jan. 2003 to Dec. 2003	n/a	0.077	15.0	n/a	n/a	0.050	0.026	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sherwood Park[5]	small urban	Jan. 2003 to Dec. 2003	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Caroline[6]	rural	Jan. 2003 to Dec. 2003	n/a	0.084	8.1	0.0	n/a	0.074	0.035	n/a	0.051	0.046	n/a	n/a	n/a	n/a

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n/a - Parameter not monitored or data not available
bd - Below lower detection limit of analyzer

Table A5 Chronological listing of all one-hour average concentrations measured during the 2003-2004 Lakeland Area survey.

Site #	Date	Times (MST)	CO ppm	NH_3 ppm	CH_4 ppm	RHC ppm	THC ppm	PAH ng/m^3	NO_2 ppm	NO ppm	NO_x ppm	O_3 ppm	TSP $\mu g/m^3$	PM_{10} mg/m^3	$PM_{2.5}$ mg/m^3	H_2S ppm	SO_2 ppm	TRS ppm
3	26-May-03	11:50 to 12:50	0.2	0.003	2.4	0.1	2.5	bd	0.001	0.004	0.003	0.037	4	3	1	bd	0.001	0.001
12	26-May-03	16:57 to 17:57	0.7	0.010	2.4	0.1	2.5	bd	bd	0.001	0.001	0.040	8	5	1	bd	0.001	bd
1	27-May-03	09:03 to 10:03	0.4	0.008	3.6	0.7	4.2	3.3	0.008	0.010	0.012	0.043	268	179	22	bd	bd	0.002
7	27-May-03	11:06 to 12:06	0.2	0.002	2.1	0.4	2.4	3.0	0.002	0.001	0.002	0.046	6	3	1	bd	bd	bd
9	27-May-03	16:21 to 17:21	0.2	bd	2.1	0.3	2.4	bd	0.001	0.001	0.001	0.048	7	5	1	bd	bd	bd
10	28-May-03	15:25 to 16:25	bd	0.001	2.5	0.2	2.6	bd	0.004	0.004	0.008	0.049	46	32	5	bd	0.001	0.001
9	28-May-03	17:09 to 18:09	0.1	bd	2.5	0.2	2.5	bd	0.003	0.003	0.006	0.045	11	7	1	bd	bd	bd
10	29-May-03	09:43 to 10:43	0.1	0.002	2.4	0.5	2.8	4.8	0.004	0.010	0.011	0.039	9	6	1	0.001	0.001	0.001
7	29-May-03	16:47 to 17:47	0.1	bd	2.3	0.2	2.5	bd	0.001	0.001	0.001	0.040	7	4	1	bd	bd	0.001
3	29-May-03	18:55 to 19:55	bd	bd	2.1	0.2	2.3	bd	0.001	0.001	0.001	0.032	2	2	bd	bd	bd	0.001
12	30-May-03	08:00 to 09:00	0.1	bd	2.0	0.1	2.1	bd	0.001	0.001	0.003	0.018	5	3	bd	bd	bd	0.001
1	30-May-03	10:07 to 11:07	0.9	0.002	3.3	1.4	4.2	bd	0.002	0.004	0.007	0.031	10	6	1	bd	bd	bd
1	8-Sep-03	11:52 to 12:52	0.3	0.006	3.7	1.2	4.9	3.1	0.005	0.005	0.012	0.033	162	90	8	0.006	0.001	0.003
12	8-Sep-03	13:35 to 14:35	0.2	0.001	2.1	bd	2.1	bd	0.001	0.001	0.002	0.033	8	6	1	bd	0.001	bd
10	8-Sep-03	17:37 to 18:37	0.1	0.005	2.5	0.1	2.7	bd	0.001	0.001	0.002	0.026	39	26	4	bd	0.001	0.001
3	8-Sep-03	19:35 to 20:35	0.1	0.004	2.1	bd	2.1	bd	0.001	0.001	0.001	0.025	6	4	1	bd	bd	bd
7	9-Sep-03	09:27 to 10:27	bd	0.009	4.1	0.2	4.1	7.7	0.009	0.015	0.019	0.012	128	75	9	0.001	bd	bd
9	9-Sep-03	10:45 to 11:45	bd	0.001	2.0	bd	2.0	bd	0.002	0.002	0.004	0.017	70	43	6	bd	bd	bd
9	10-Sep-03	14:21 to 15:21	bd	0.001	2.1	bd	2.0	bd	0.001	0.002	0.001	0.026	8	6	1	0.001	bd	bd
7	10-Sep-03	16:57 to 17:57	0.1	0.001	2.0	bd	2.0	bd	0.002	0.005	0.003	0.031	190	133	16	0.001	bd	bd
10	11-Sep-03	14:27 to 15:21	0.1	0.006	1.7	0.7	2.2	bd	0.003	0.006	0.006	0.046	95	59	6	bd	0.004	0.001
1	11-Sep-03	18:22 to 19:22	bd	0.009	2.7	0.3	3.0	bd	0.005	0.004	0.010	0.043	69	46	6	bd	0.003	bd
3	12-Sep-03	09:16 to 10:15	bd	0.008	1.9	bd	1.8	bd	0.001	0.002	0.002	0.019	5	3	bd	0.001	bd	0.001
12	12-Sep-03	10:32 to 11:32	0.1	0.008	1.8	bd	1.8	bd	bd	0.002	0.001	0.020	10	5	bd	0.001	bd	0.001
4	31-May-04	14:25 to 15:25	0.3	0.007	2.8	0.1	2.9	ND	0.001	0.004	0.004	0.029	8	6	1	0.003	0.009	0.003
4	31-May-04	15:25 to 16:25	0.2	0.001	2.6	0.2	2.8	ND	0.001	0.001	0.001	0.030	13	10	2	0.002	0.005	0.003
5	1-Jun-04	09:46 to 10:46	0.1	0.001	2.9	0.2	3.1	bd	0.009	0.014	0.020	0.022	6	5	1	0.001	0.001	bd
5	1-Jun-04	10:46 to 11:46	0.3	0.002	2.8	0.2	3.0	bd	0.007	0.011	0.017	0.024	6	4	1	bd	0.001	bd
2	1-Jun-04	12:36 to 13:36	0.2	0.001	2.8	0.8	3.6	bd	0.002	0.005	0.004	0.027	8	5	1	bd	0.001	0.001
2	1-Jun-04	13:36 to 14:36	0.2	0.007	2.4	0.5	2.9	bd	0.007	0.007	0.012	0.027	44	22	2	bd	bd	bd
2	1-Jun-04	14:36 to 15:36	0.2	0.004	3.1	4.6	7.2	bd	0.007	0.014	0.019	0.025	11	7	1	0.001	0.002	0.001
8	2-Jun-04	17:22 to 18:22	0.1	bd	2.8	0.2	3.0	bd	0.001	0.001	0.001	0.040	1505	1074	127	bd	bd	bd
8	2-Jun-04	18:22 to 19:22	0.3	bd	2.9	0.3	3.3	bd	0.002	0.002	0.002	0.036	39	26	3	bd	bd	bd
6	3-Jun-04	10:05 to 11:05	0.2	bd	3.5	0.1	3.3	9.5	0.001	bd	0.002	0.033	19	12	2	0.001	0.001	bd
6	3-Jun-04	11:21 to 12:30	0.2	0.007	3.0	0.1	2.6	bd	0.001	0.001	0.002	0.034	14	9	1	bd	0.001	0.002
11	4-Jun-04	12:04 to 13:04	0.2	0.007	3.2	bd	3.2	bd	0.002	0.016	0.007	0.039	20	11	2	0.001	0.001	bd
8	13-Sep-04	13:04 to 14:04	0.2	bd	2.4	bd	2.4	bd	0.002	0.004	0.005	0.031	ND	ND	ND	0.002	bd	0.001
8	13-Sep-04	14:04 to 15:04	0.2	0.001	2.4	bd	2.3	bd	0.002	0.002	0.004	0.033	ND	ND	ND	bd	bd	0.001
5	14-Sep-04	08:53 to 09:53	0.1	0.013	2.7	0.2	2.6	ND	0.012	0.053	0.061	0.009	15	9	2	bd	0.003	bd
5	14-Sep-04	09:53 to 10:53	0.2	0.003	2.7	0.2	2.6	ND	0.009	0.025	0.030	0.016	14	8	1	bd	0.002	bd
2	14-Sep-04	11:47 to 12:47	bd	0.004	2.4	0.4	2.6	ND	0.003	0.004	0.007	0.028	228	130	10	bd	bd	bd
2	14-Sep-04	12:47 to 13:47	bd	0.002	2.3	0.5	2.5	ND	0.002	0.004	0.006	0.030	38	24	2	bd	bd	bd
6	15-Sep-04	15:36 to 16:36	0.2	bd	2.1	0.1	2.1	bd	0.004	0.001	0.004	0.031	14	10	1	bd	bd	bd
6	15-Sep-04	16:36 to 17:36	0.4	0.001	2.8	0.5	3.1	14.1	0.011	0.009	0.018	0.020	92	57	7	0.001	0.001	bd
6	17-Sep-04	09:28 to 10:28	0.1	bd	2.0	bd	2.1	bd	bd	0.001	0.001	0.019	15	9	1	0.001	bd	0.001
6	17-Sep-04	10:28 to 11:28	0.1	bd	2.1	bd	2.1	bd	bd	bd	bd	0.022	13	8	1	bd	bd	0.001

ND – not determined (analyzer not functioning)
bd – below detection limit of analyzer

Table A6 **Weather Conditions and Operator's Remarks in the 2003-2004 Lakeland Area survey, (Spring and Fall 2003/2004) for ambient site monitoring locations.**

Date	Site	Time	Temp.	Relative Humidity	Wind Speed	Wind Direction	Operator's Remarks
		(MST)	°C	%	km/h	degrees	
26-May-03	3	11:50 to 12:50	17.5	59.0	14.2	230	No unusual interferences. Trace PAH from diesel exhaust.
26-May-03	12	16:57 to 17:57	18.2	55.1	9.8	293	Trace NH3 detected
27-May-03	1	09:03 to 10:03	23.8	24.1	8.7	258	Monitored on east side of plant at 2 locations.
27-May-03	7	11:06 to 12:06	25.1	19.1	15.0	288	No elevated readings
27-May-03	9	16:21 to 17:21	23.4	25.1	11.7	252	
28-May-03	10	15:25 to 16:25	26.7	22.9	7.8	191	Very little traffic and no odours
28-May-03	9	17:09 to 18:09	22.2	34.5	8.2	74	
29-May-03	10	09:43 to 10:43	16.1	63.3	18.6	296	Mostly diesel emissions from trucks driving by MAML
29-May-03	7	16:47 to 17:47	17.9	47.1	13.7	292	No elevated readings
29-May-03	3	18:55 to 19:55	14.6	61.6	14.0	244	No elevated readings
30-May-03	12	08:00 to 09:00	13.0	77.3	4.6	153	No elevated readings
30-May-03	1	10:07 to 11:07	17.6	57.4	5.7	168	Elevated THC's
8-Sep-03	1	11:52 to 12:52	20.9	57.7	13.5	256	70m from truck offloading platform on south end of plant. Road dust from trucks. Hydrocarbon odours. 90% overcast
8-Sep-03	12	13:35 to 14:35	16.8	58.6	22.2	324	Stop at Rge Rd 55 and Hwy 646 about 2.5 mi. North of residence. 100% overcast. No elevated readings.
8-Sep-03	10	17:37 to 18:37	16.9	63.8	6.0	285	Stop at SE corner on site 170m from stack/tanks. Road dust from trucks. 100% overcast and light rain near end of hour.
8-Sep-03	3	19:35 to 20:35	15.0	67.4	10.6	315	East end of town. No odours. 100% overcast with light rain.
9-Sep-03	7	09:27 to 10:27	11.3	95.1	9.7	312	Stop on main street across (east of) community hall. All elevated readings are from vehicle traffic. 100% overcast and light rain.
9-Sep-03	9	10:45 to 11:45	11.0	103.4	16.0	303	No odours. 100% overcast and rain.
10-Sep-03	9	14:21 to 15:21	19.3	48.1	18.8	283	No elevated readings. 50% overcast.
10-Sep-03	7	16:57 to 17:57	20.7	37.3	6.3	271	Stop on main street across (east of) community hall. All elevated readings are from vehicle traffic. 10% overcast.
11-Sep-03	10	14:27 to 15:21	18.0	32.1	15.9	275	Sample at SE corner of plant on main road and 200m from tanks. Some particulate from trucks. 80% overcast.
11-Sep-03	1	18:22 to 19:22	14.9	52.3	14.0	250	Sample 150m east of facility. Very light truck traffic. 50% overcast.
12-Sep-03	3	09:16 to 10:15	11.0	85.5	15.9	325	Sample at east end of town. No odours. 100% overcast (no rain).
12-Sep-03	12	10:32 to 11:32	10.8	86.1	21.7	319	Stop at Rge Rd 55 and Hwy 646 about 2.5 mi. North of residence. 100% overcast and light rain. No elevated readings.
31-May-04	4	14:25 to 15:25	9.5	89.0	6.8	260	500m downwind of plant off site. Odours and occasional
31-May-04	4	15:25 to 16:25	10.4	84.8	8.9	201	truck traffic over the 2 hours.
1-Jun-04	5	09:46 to 10:46	15.5	61.4	6.2	264	Odours from truck loading only. Trucks are 50m west of MAML
1-Jun-04	5	10:46 to 11:46	15.5	59.5	6.4	239	Odours from truck loading only. Trucks are 50m west of MAML
1-Jun-04	2	12:36 to 13:36	16.1	53.4	6.7	123	On site at NW corner. Nearest tank is 45m SE of MAML
1-Jun-04	2	13:36 to 14:36	16.8	50.6	6.5	139	Detect odours. NOX from vehicle traffic and RHC, TRS, H2S from
1-Jun-04	2	14:36 to 15:36	18.0	47.0	7.3	117	2 Gibson trucks 40m from MAML.

Table A5 Chronological listing of all one-hour average concentrations measured during the 2003-2004 Lakeland Area survey.

Site #	Date	Times (MST)	CO ppm	NH_3 ppm	CH_4 ppm	RHC ppm	THC ppm	PAH ng/m³	NO_2 ppm	NO ppm	NO_x ppm	O_3 ppm	TSP µg/m³	PM_{10} mg/m³	$PM_{2.5}$ mg/m³	H_2S ppm	SO_2 ppm	TRS ppm
3	26-May-03	11:50 to 12:50	0.2	0.003	2.4	0.1	2.5	bd	0.001	0.004	0.003	0.037	4	3	1	bd	0.001	0.001
12	26-May-03	16:57 to 17:57	0.7	0.010	2.4	0.1	2.5	bd	bd	0.001	0.001	0.040	8	5	1	bd	0.001	bd
1	27-May-03	09:03 to 10:03	0.4	0.008	3.6	0.7	4.2	3.3	0.008	0.010	0.012	0.043	268	179	22	bd	bd	0.002
7	27-May-03	11:06 to 12:06	0.2	0.002	2.1	0.4	2.4	3.0	0.002	0.001	0.002	0.045	6	3	1	bd	bd	bd
9	27-May-03	16:21 to 17:21	0.2	bd	2.1	0.3	2.4	bd	0.001	0.001	0.001	0.048	7	5	1	bd	bd	bd
10	28-May-03	15:25 to 16:25	bd	0.001	2.5	0.2	2.6	bd	0.004	0.004	0.008	0.049	46	32	5	bd	0.001	0.001
9	28-May-03	17:09 to 18:09	0.1	bd	2.5	0.2	2.5	bd	0.003	0.003	0.006	0.045	11	7	1	bd	bd	bd
10	29-May-03	09:43 to 10:43	0.1	0.002	2.4	0.5	2.8	4.8	0.004	0.010	0.011	0.039	9	6	1	0.001	0.001	0.001
7	29-May-03	16:47 to 17:47	0.1	bd	2.3	0.2	2.5	bd	0.001	0.001	0.001	0.040	7	4	1	bd	bd	0.001
3	29-May-03	18:55 to 19:55	bd	bd	2.1	0.2	2.3	bd	0.001	0.001	0.001	0.032	2	2	bd	bd	bd	0.001
12	30-May-03	08:00 to 09:00	0.1	bd	2.0	0.1	2.1	bd	0.001	0.001	0.003	0.018	5	3	bd	bd	bd	0.001
1	30-May-03	10:07 to 11:07	0.9	0.002	3.3	1.4	4.2	bd	0.002	0.004	0.007	0.031	10	6	1	bd	bd	bd
1	8-Sep-03	11:52 to 12:52	0.3	0.006	3.7	1.2	4.9	3.1	0.005	0.005	0.012	0.033	162	90	8	0.006	0.001	0.003
12	8-Sep-03	13:35 to 14:35	0.2	0.001	2.1	bd	2.1	bd	0.001	0.001	0.002	0.033	8	6	1	bd	0.001	bd
10	8-Sep-03	17:37 to 18:37	0.1	0.005	2.5	0.1	2.7	bd	0.001	0.001	0.002	0.026	39	26	4	bd	0.001	0.001
3	8-Sep-03	19:35 to 20:35	0.1	0.004	2.1	bd	2.1	bd	0.001	0.001	0.001	0.025	6	4	1	bd	bd	bd
7	9-Sep-03	09:27 to 10:27	bd	0.009	4.1	0.2	4.1	7.7	0.009	0.015	0.019	0.012	128	75	9	0.001	bd	bd
9	9-Sep-03	10:45 to 11:45	bd	0.001	2.0	bd	2.0	bd	0.002	0.002	0.004	0.017	70	43	6	bd	ad	bd
9	10-Sep-03	14:21 to 15:21	bd	0.001	2.1	bd	2.0	bd	0.001	0.002	0.001	0.026	8	6	1	0.001	bd	bd
7	10-Sep-03	16:57 to 17:57	0.1	0.001	2.0	bd	2.0	bd	0.002	0.005	0.003	0.031	190	133	16	0.001	bd	bd
10	11-Sep-03	14:27 to 15:21	0.1	0.006	1.7	0.7	2.2	bd	0.003	0.006	0.006	0.046	95	59	6	bd	0.004	0.001
1	11-Sep-03	18:22 to 19:22	bd	0.009	2.7	0.3	3.0	bd	0.005	0.004	0.010	0.043	69	46	6	bd	0.003	bd
3	12-Sep-03	09:16 to 10:15	bd	0.008	1.9	bd	1.8	bd	0.001	0.002	0.002	0.019	5	3	bd	0.001	bd	0.001
12	12-Sep-03	10:32 to 11:32	0.1	0.008	1.8	bd	1.8	bd	bd	0.002	0.001	0.020	10	5	bd	0.001	bd	0.001
4	31-May-04	14:25 to 15:25	0.3	0.007	2.8	0.1	2.9	ND	0.001	0.004	0.004	0.029	8	6	1	0.003	0.009	0.003
4	31-May-04	15:25 to 16:25	0.2	0.001	2.6	0.2	2.8	ND	0.001	0.001	0.001	0.030	13	10	2	0.002	0.005	0.003
5	1-Jun-04	09:46 to 10:46	0.1	0.001	2.9	0.2	3.1	bd	0.009	0.014	0.020	0.022	6	5	1	0.001	0.001	bd
5	1-Jun-04	10:46 to 11:46	0.3	0.002	2.8	0.2	3.0	bd	0.007	0.011	0.017	0.024	6	4	1	bd	0.001	bd
2	1-Jun-04	12:36 to 13:36	0.2	0.001	2.8	0.8	3.6	bd	0.002	0.005	0.004	0.027	8	5	1	bd	0.001	0.001
2	1-Jun-04	13:36 to 14:36	0.2	0.007	2.4	0.5	2.9	bd	0.007	0.007	0.012	0.027	44	22	2	bd	bd	bd
2	1-Jun-04	14:36 to 15:36	0.2	0.004	3.1	4.6	7.2	bd	0.007	0.014	0.019	0.025	11	7	1	0.001	0.002	0.001
8	2-Jun-04	17:22 to 18:22	0.1	bd	2.8	0.2	3.0	bd	0.001	0.001	0.001	0.040	1505	1074	127	bd	bd	bd
8	2-Jun-04	18:22 to 19:22	0.3	bd	2.9	0.3	3.3	bd	0.002	0.002	0.002	0.036	39	26	3	bd	bd	bd
6	3-Jun-04	10:05 to 11:05	0.2	bd	3.5	0.1	3.3	9.5	0.001	bd	0.002	0.033	19	12	2	0.001	0.001	bd
6	3-Jun-04	11:21 to 12:30	0.2	0.007	3.0	0.1	2.6	bd	0.001	0.001	0.002	0.034	14	9	1	bd	0.001	0.002
11	4-Jun-04	12:04 to 13:04	0.2	0.007	3.2	bd	3.2	bd	0.002	0.016	0.007	0.039	20	11	2	0.001	0.001	bd
8	13-Sep-04	13:04 to 14:04	0.2	bd	2.4	bd	2.4	bd	0.002	0.004	0.005	0.031	ND	ND	ND	0.002	bd	0.001
8	13-Sep-04	14:04 to 15:04	0.2	0.001	2.4	bd	2.3	bd	0.002	0.002	0.004	0.033	ND	ND	ND	bd	bd	0.001
5	14-Sep-04	08:53 to 09:53	0.1	0.013	2.7	0.2	2.6	ND	0.012	0.053	0.061	0.009	15	9	2	bd	0.003	bd
5	14-Sep-04	09:53 to 10:53	0.2	0.003	2.7	0.2	2.6	ND	0.009	0.025	0.030	0.016	14	8	1	bd	0.002	bd
2	14-Sep-04	11:47 to 12:47	bd	0.004	2.4	0.4	2.6	ND	0.003	0.004	0.007	0.028	228	130	10	bd	bd	bd
2	14-Sep-04	12:47 to 13:47	bd	0.002	2.3	0.5	2.5	ND	0.002	0.004	0.006	0.030	38	24	2	bd	bd	bd
6	15-Sep-04	15:36 to 16:36	0.2	bd	2.1	0.1	2.1	bd	0.004	0.001	0.004	0.031	14	10	1	bd	bd	bd
6	15-Sep-04	16:36 to 17:36	0.4	0.001	2.8	0.5	3.1	14.1	0.011	0.009	0.018	0.020	92	57	7	0.001	0.001	bd
6	17-Sep-04	09:28 to 10:28	0.1	bd	2.0	bd	2.1	bd	bd	0.001	0.001	0.019	15	9	1	0.001	bd	0.001
6	17-Sep-04	10:28 to 11:28	0.1	bd	2.1	bd	2.1	bd	bd	bd	bd	0.022	13	8	1	bd	bd	0.001

ND – not determined (analyzer not functioning)
bd – below detection limit of analyzer

Table A6 **Weather Conditions and Operator's Remarks in the 2003-2004 Lakeland Area survey, (Spring and Fall 2003/2004) for ambient site monitoring locations.**

Date	Site	Time	Temp.	Relative Humidity	Wind Speed	Wind Direction	Operator's Remarks
		(MST)	°C	%	km/h	degrees	
26-May-03	3	11:50 to 12:50	17.5	59.0	14.2	230	No unusual interferences. Trace PAH from diesel exhaust.
26-May-03	12	16:57 to 17:57	18.2	55.1	9.8	293	Trace NH3 detected
27-May-03	1	09:03 to 10:03	23.8	24.1	8.7	258	Monitored on east side of plant at 2 locations.
27-May-03	7	11:06 to 12:06	25.1	19.1	15.0	288	No elevated readings
27-May-03	9	16:21 to 17:21	23.4	25.1	11.7	252	
28-May-03	10	15:25 to 16:25	26.7	22.9	7.8	191	Very little traffic and no odours
28-May-03	9	17:09 to 18:09	22.2	34.5	8.2	74	
29-May-03	10	09:43 to 10:43	16.1	63.3	18.6	296	Mostly diesel emissions from trucks driving by MAML
29-May-03	7	16:47 to 17:47	17.9	47.1	13.7	292	No elevated readings
29-May-03	3	18:55 to 19:55	14.6	61.6	14.0	244	No elevated readings
30-May-03	12	08:00 to 09:00	13.0	77.3	4.6	153	No elevated readings
30-May-03	1	10:07 to 11:07	17.6	57.4	5.7	168	Elevated THC's
8-Sep-03	1	11:52 to 12:52	20.9	57.7	13.5	256	70m from truck offloading platform on south end of plant. Road dust from trucks. Hydrocarbon odours. 90% overcast
8-Sep-03	12	13:35 to 14:35	16.8	58.6	22.2	324	Stop at Rge Rd 55 and Hwy 646 about 2.5 mi. North of residence. 100% overcast. No elevated readings
8-Sep-03	10	17:37 to 18:37	16.9	63.8	6.0	285	Stop at SE corner on site 170m from stack/tanks. Road dust from trucks. 100% overcast and light rain near end of hour.
8-Sep-03	3	19:35 to 20:35	15.0	67.4	10.6	315	East end of town. No odours. 100% overcast with light rain.
9-Sep-03	7	09:27 to 10:27	11.3	95.1	9.7	312	Stop on main street across (east of) community hall. All elevated readings are from vehicle traffic. 100% overcast and light rain.
9-Sep-03	9	10:45 to 11:45	11.0	103.4	16.0	303	No odours. 100% overcast and rain.
10-Sep-03	9	14:21 to 15:21	19.3	48.1	18.8	283	No elevated readings. 50% overcast.
10-Sep-03	7	16:57 to 17:57	20.7	37.3	6.3	271	Stop on main street across (east of) community hall. All elevated readings are from vehicle traffic. 10% overcast.
11-Sep-03	10	14:27 to 15:21	18.0	32.1	15.9	275	Sample at SE corner of plant on main road and 200m from tanks. Some particulate from trucks. 80% overcast.
11-Sep-03	1	18:22 to 19:22	14.9	52.3	14.0	250	Sample 150m east of facility. Very light truck traffic. 50% overcast.
12-Sep-03	3	09:16 to 10:15	11.0	85.5	15.9	325	Sample at east end of town. No odours. 100% overcast (no rain).
12-Sep-03	12	10:32 to 11:32	10.8	86.1	21.7	319	Stop at Rge Rd 55 and Hwy 646 about 2.5 mi. North of residence. 100% overcast and light rain. No elevated readings.
31-May-04	4	14:25 to 15:25	9.5	89.0	6.8	260	500m downwind of plant off site. Odours and occasional
31-May-04	4	15:25 to 16:25	10.4	84.8	8.9	201	truck traffic over the 2 hours.
1-Jun-04	5	09:46 to 10:46	15.5	61.4	6.2	264	Odours from truck loading only. Trucks are 50m west of MAML
1-Jun-04	5	10:46 to 11:46	15.5	59.5	6.4	239	Odours from truck loading only. Trucks are 50m west of MAML
1-Jun-04	2	12:36 to 13:36	16.1	53.4	6.7	123	On site at NW corner. Nearest tank is 45m SE of MAML
1-Jun-04	2	13:36 to 14:36	16.8	50.6	6.5	139	Detect odours. NOX from vehicle traffic and RHC, TRS, H2S from
1-Jun-04	2	14:36 to 15:36	18.0	47.0	7.3	117	2 Gibson trucks 40m from MAML.

(...continued)

Table A6 (...continued) Weather Conditions and Operator's Remarks in the 2003-2004 Lakeland Area survey, (Spring and Fall 2003/2004) for ambient site monitoring locations.

Date	Site	Time	Temp.	Relative Humidity	Wind Speed	Wind Direction	Operator's Remarks
		(MST)	°C	%	km/h	degrees	
2-Jun-04	8	17:22 to 18:22	19.8	48.3	3.1	124	No odours detected
2-Jun-04	8	18:22 to 19:22	17.6	60.7	5.2	97	No odours detected
3-Jun-04	6	10:05 to 11:05	20.9	33.3	8.9	245	Removed data containing readings from lawnmower and tractor exhaust. 1 mi east of La Corey on Hwy 55
3-Jun-04	6	11:21 to 12:30	21.5	29.0	17.9	260	No odours at this location
4-Jun-04	11	12:04 to 13:04	28.1	20.4	5.7	202	Most Slough's are dried up. No odours
13-Sep-04	8	13:04 to 14:04	20.0	34.5	3.5	137	No Odours of significance
13-Sep-04	8	14:04 to 15:04	20.6	31.3	3.2	132	No Odours of significance
14-Sep-04	5	08:53 to 09:53	13.6	58.7	4.7	120	North side of plant and 250-300m from main stack.
14-Sep-04	5	09:53 to 10:53	16.4	48.6	5.1	111	North side of plant and 250-300m from main stack.
14-Sep-04	2	11:47 to 12:47	18.3	38.4	8.1	152	North side of plant and 300m from storage tanks.
14-Sep-04	2	12:47 to 13:47	18.7	36.8	8.1	155	North side of plant and 300m from storage tanks.
15-Sep-04	6	15:36 to 16:36	15.6	57.9	7.4	158	Elevated Particulate from heavy rainfall
15-Sep-04	6	16:36 to 17:36	17.6	47.5	7.5	251	Elevated Particulate from heavy rainfall
17-Sep-04	6	09:28 to 10:28	16.4	38.3	5.3	260	Locate just outside the gate of res. No odours or elevated readings detected
17-Sep-04	6	10:28 to 11:28	15.2	50.0	6.2	103	Locate just outside the gate of res. No odours or elevated readings detected

Table A6 (...continued) Weather Conditions and Operator's Remarks in the 2003-2004 Lakeland Area survey, (Spring and Fall 2003/2004) for ambient site monitoring locations.

Date	Site	Time (MST)	Temp. °C	Relative Humidity %	Wind Speed km/h	Wind Direction degrees	Operator's Remarks
2-Jun-04	8	17:22 to 18:22	19.8	48.3	3.1	124	No odours detected
2-Jun-04	8	18:22 to 19:22	17.6	60.7	5.2	97	No odours detected
3-Jun-04	6	10:05 to 11:05	20.9	33.3	8.9	245	Removed data containing readings from lawnmower and tractor exhaust. 1 mi east of La Corey on Hwy 55
3-Jun-04	6	11:21 to 12:30	21.5	29.0	17.9	260	No odours at this location
4-Jun-04	11	12:04 to 13:04	28.1	20.4	5.7	202	Most Slough's are dried up. No odours
13-Sep-04	8	13:04 to 14:04	20.0	34.5	3.5	137	No Odours of significance
13-Sep-04	8	14:04 to 15:04	20.6	31.3	3.2	132	No Odours of significance
14-Sep-04	5	08:53 to 09:53	13.6	58.7	4.7	120	North side of plant and 250-300m from main stack.
14-Sep-04	5	09:53 to 10:53	16.4	48.6	5.1	111	North side of plant and 250-300m from main stack.
14-Sep-04	2	11:47 to 12:47	18.3	38.4	8.1	152	North side of plant and 300m from storage tanks.
14-Sep-04	2	12:47 to 13:47	18.7	36.8	8.1	155	North side of plant and 300m from storage tanks.
15-Sep-04	6	15:36 to 16:36	15.6	57.9	7.4	158	Elevated Particulate from heavy rainfall
15-Sep-04	6	16:36 to 17:36	17.6	47.5	7.5	251	Elevated Particulate from heavy rainfall
17-Sep-04	6	09:28 to 10:28	16.4	38.3	5.3	260	Locate just outside the gate of res. No odours or elevated readings detected
17-Sep-04	6	10:28 to 11:28	15.2	50.0	6.2	103	Locate just outside the gate of res. No odours or elevated readings detected